Module 1
Scoping

Background

Scoping is a critical first step in conducting Remedial Investigation/Feasibility Study (RI/FS) projects at Department of Energy (DOE) sites. At a minimum, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Section 300.430(b), requires that DOE

(1) Assemble and evaluate available site data, including the results of any removal actions, remedial preliminary assessment and site inspections, and the National Priorities List (NPL) ranking process.

(2) Develop a conceptual understanding of the site on the basis of evaluation of available data.

(3) Identify likely response scenarios and potentially applicable technologies and operable units that may address site problems.

(4) Undertake limited data collection efforts or studies where such information will assist in scoping the RI/FS or accelerate response actions, and begin to identify the need for treatability studies, as appropriate.

(5) Identify the type, quality, and quantity of the data that will be collected during the RI/FS to support decisions about remedial response activities.

(6) If natural resources are or may be adversely affected by the release, ensure notification of the appropriate trustees so that proper actions can be initiated.

(7) Initiate the identification of potential federal and state applicable or relevant and appropriate requirements (ARARs) and, as appropriate, other criteria, advisories, or guidance to be considered.

(8) Develop RI/FS work plan. Elements include the following:

- Sampling and analysis plans that provide for data accumulation of sufficient quality and quantity to satisfy data needs. Sampling and analysis plans will be reviewed and approved by the Environmental Protection Agency (EPA) and other agencies, as appropriate. Sampling and analysis plans will consist of two parts as follows:

    (i) The Field Sampling Plan (FSP), which describes the number, type, and location of samples and the type of analyses

    (ii) The quality assurance project plan (QAPP), which describes policy, organization, and functional activities and the data quality objectives (DQOs) and measures necessary to achieve adequate data for use in selecting the appropriate remedy.

- Site-specific Health and Safety Plans (HSPs) that specify, at a minimum, employee training and protective equipment, medical surveillance requirements, standard operating procedures, and a contingency plan.

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Scoping should be tailored to site-specific requirements. For example, the DOE project manager or designee will conduct initial meetings with the extended project team and stakeholders to identify their concerns and to share initial DOE scoping information.

Organization

Module 1 is divided into five submodules

- 1.1 Project Management Approach
- 1.2 Site Understanding
- 1.3 Initial Evaluation
- 1.4 Data Collection Plan
- 1.5 Work Plan Preparation

Documents

Informal and formal documents will be developed during scoping to document and communicate planning activities. These documents include the following:

(1) Several technical memoranda prepared to communicate technical approaches to the extended project team. These memoranda may describe an initial strategy of how the RI/FS project will be conducted, a summary ARARs evaluation, results of the preliminary risk assessment, a list of preliminary technologies.

(2) The RI/FS work plan. This document is the major end-point of scoping activities and is typically the first primary deliverable under most compliance agreements. Concepts presented in the technical memoranda will be incorporated into the RI/FS work plan to direct all subsequent RI/FS activities.

Submodule 1.1 Project Management Approach

Scoping	
1.1	**Project Management Approach**
1.2	Site Understanding
1.3	Initial Evaluation
1.4	Data Collection Plan
1.5	Work Plan Preparation

1.1 Project Management Approach
• Internal Kickoff Meeting
• Internal Project Approach
• Stakeholders Meeting
• Consensus Approach Memorandum

Submodule 1.1 Project Management Approach

Background

Project planning includes identifying goals, strategies, and key steps. Although not required by the NCP, an initial strategy is a critical step in starting a purposeful RI/FS project. The initial strategy begins as an internal project approach developed during a kickoff meeting, and becomes a matter of consensus through an extended project team and stakeholders meeting.

The internal kickoff meeting is attended by DOE managers and staff, and the DOE contractor responsible for developing the work plan. The purpose is to develop an initial approach to the challenges presented by the investigation and remediation. The stakeholders meeting includes DOE managers and staff, the DOE contractor, Federal and State regulators, and interested public groups and individuals. The purpose is to arrive at a consensus strategy for the investigation and remediation project.

Organization

Submodule 1.1 discusses the following:

- Internal kickoff meeting
- Internal project approach
- Stakeholders meeting
- Consensus approach memorandum

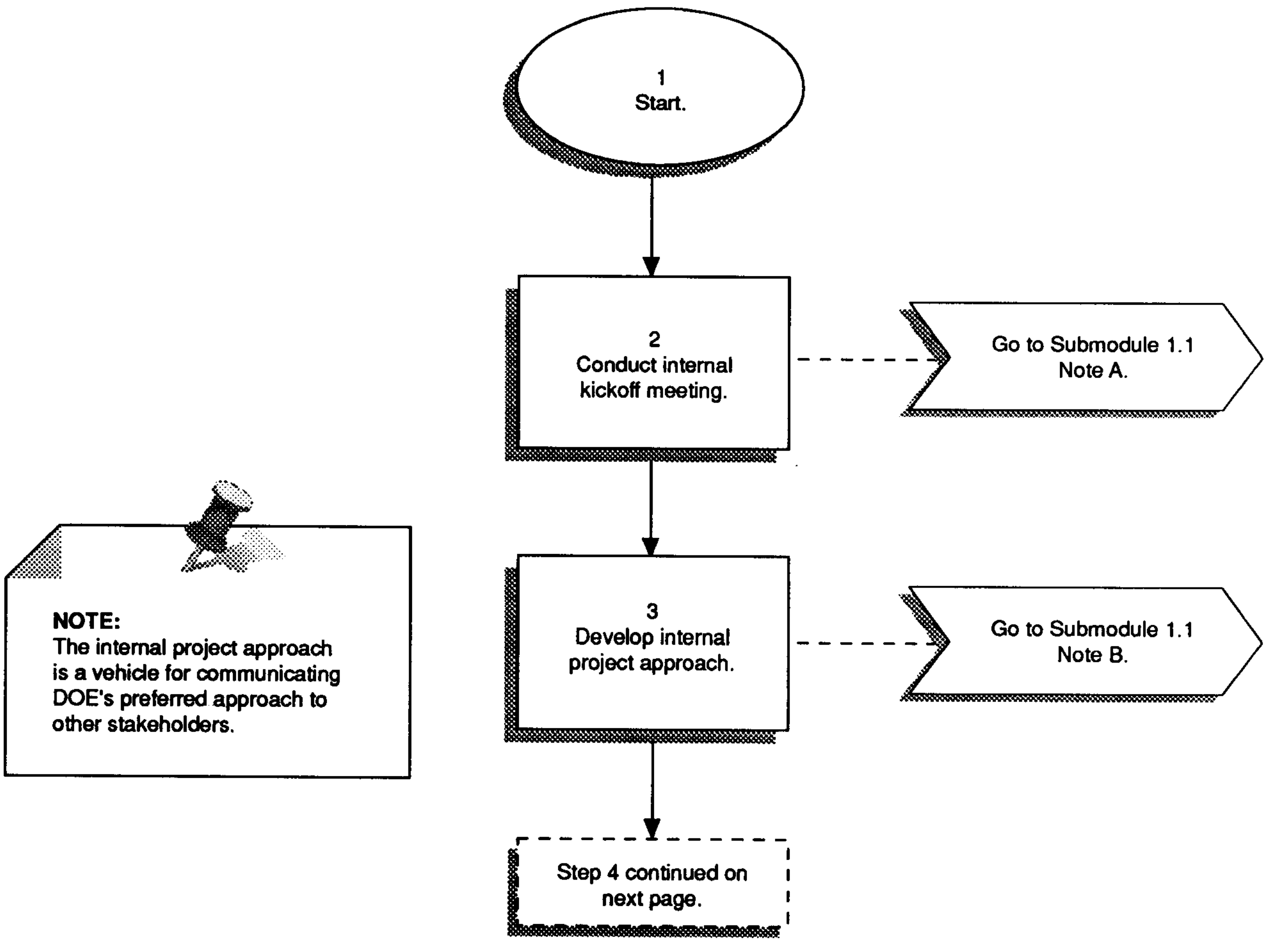
In addition, more detailed information is provided in the following notes:

- Note A–Project Management Approach Meetings
- Note B–Public Participation Strategy

Sources

1. U.S. EPA, October 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Interim Final, EPA/540/G89/004, OSWER Directive 9356.3-01.

Submodule 1.1 Project Management Approach



Step 1. Start.

Step 2. **Conduct internal kickoff meeting.** Before starting negotiations or communications with the extended project team, a DOE project team meeting should be held to identify and discuss positions on key RI/FS project issues (i.e., develop an internal project strategy). The DOE project manager [operable unit (OU) manager] or designee is responsible for coordinating the meeting.

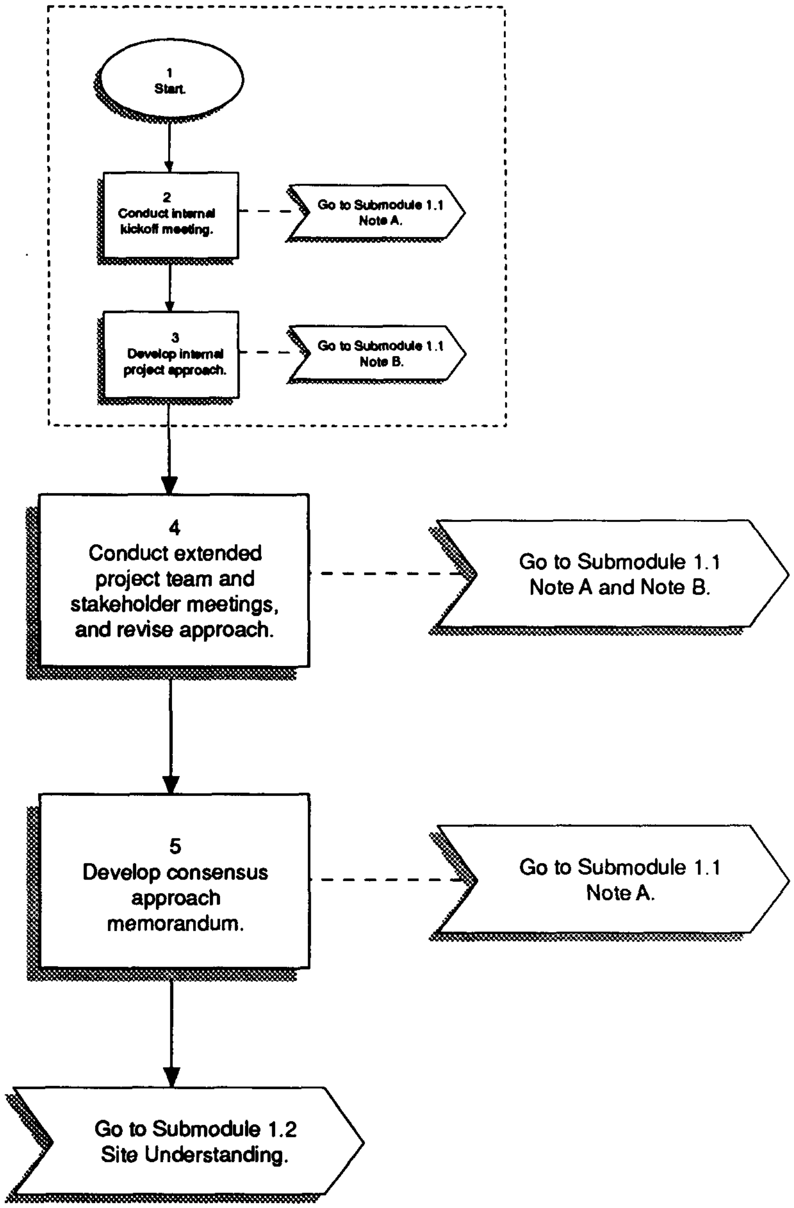
Limit the agenda for the internal kickoff meeting to RI/FS-related issues for project planning and execution: quantity, quality, and use of existing site data; regulatory issues; items of community interest; internal logistics (e.g., site access, excavation permits, security); unique features that could impact RI activities or remedy selection (e.g., secured access entrances); and relevance of site risk scenarios (e.g., future use). Attendees should include those with DOE responsibility and authority for oversight. See Submodule 1.1, Note A, for recommended attendees and agenda items that should be discussed. A typical internal project team kickoff meeting could range from 4 to 16 hours. The goal of the meeting is to reach consensus on positions about key RI/FS issues. This meeting also may include discussion of key administrative topics such as establishing and maintaining the Administrative Record, and other project protocols.

Step 3. **Develop internal project approach.** An internal project approach is developed on the basis of results of the DOE project team kickoff meeting. This internal project strategy is DOE's initial approach for planning and conducting the RI/FS. It should include at a minimum (1) a goal statement; (2) an initial understanding of the site, its problems, and potential remedies; (3) DOE's initial position on key issues as discussed at the internal kickoff meeting; (4) an initial identification of opportunities to streamline the project; (5) an initial approach for conducting the risk assessment; and (6) a strategic analysis of public participation issues (see Submodule 1.1, Note B). The objective is a well-conceived approach for how DOE would prefer to manage the project−an approach that can be clearly communicated to stakeholders as an initial position.

Readily available site data should be collected before the meeting. Information collected at this point is only a beginning to the effort to collect available data; data collection will continue throughout the scoping process. The internal project approach should include a clear and concise statement of the well-understood site problems and the desired remediation objectives, and should clearly identify the unknowns and uncertainties.

The internal project approach also provides an opportunity to articulate a bias for action and streamlining opportunities. Streamlining opportunities may include use of accelerated actions (e.g., expedited response actions, limited field investigations), limited data collection and analysis during scoping, and concurrent task scheduling. Compliance agreements can significantly constrain opportunities to streamline, while still requiring ambitious schedules (e.g., requiring a full two-phase RI for all OUs). Note that the internal project approach is not a formally written document, but rather a compilation of concepts and tentative approaches for presentation to the extended project team and stakeholders.

Submodule 1.1 Project Management Approach (cont.)



NOTE:
Project approach needs to be integrated with specific compliance agreements, facility mission plans, site treatment plans, waste management plans, and D&D programs.

NOTE:
DOE is responsible for compiling and maintaining the Administrative Record file. This is a critical activity that should be addressed during the initial strategy and initiated early in the RI/FS process. More information is provided in Submodule 6.1, Note D.

Step 4. **Conduct extended project team and stakeholder meetings, and revise approach.** Meeting with the extended project team and stakeholders is recommended by the RI/FS Guidance (EPA, 1988). The meetings should provide opportunities (1) to communicate the initial site understanding and DOE's initial approach for planning and conducting the RI/FS with the extended project team and stakeholders, (2) to identify issues of concern to these groups, (3) to resolve divergent viewpoints and arrive at a consensus approach to the RI/FS, and (4) to set a precedent for stakeholder involvement throughout the project.

Coordination of these meetings is DOE's responsibility as the lead agency. See Submodule 1.1, Note A, for additional detail on potential discussion items and a list of attendees for each meeting. For example, as much as half of a 1-day extended project team meeting is typically used to present current site understanding (available data and preliminary list of site problems). See Submodule 1.1, Note B, for additional detail on development of public participation strategy.

A primary objective of the extended project team and stakeholders meeting is to develop a common understanding of the scope and proposed approach to the upcoming site activities. The meeting will include a discussion of the internal project approach and provide an opportunity for identifying issues of concern to the various stakeholders. A written outline of the internal project approach might be distributed to support the presentation. The internal project approach then becomes the basis for developing the initial (consensus) approach with the stakeholders.

An additional objective of these meetings is to set a precedent for interaction between the extended project team and the stakeholders. Every major step of the RI/FS process eventually will be a matter of consensus. Any major step taken by DOE without prior agreement with key parties may have to be redone, which wastes time and affects the schedule. Keeping the extended project team and the stakeholders fully informed and involved, and seeking prior consensus are fundamental to implementing a smooth RI/FS project.

Step 5. **Develop consensus approach memorandum.** Summarize results of stakeholder meetings by noting points from the agenda topics (see Submodule 1.1, Note A). Topics for which consensus is reached should be reflected in the work plan. Final consensus on all topics will not be possible at this point (e.g., land use). For these topics, a working assumption that is subject to later change should be an outcome of the stakeholders meeting.

Note A: **Agenda Topics for Project Management Approach Meetings**

- **Available Site Data**
  Site data (e.g., monitoring data)
  Regulatory agency data
  External data [U.S. Geological Survey (USGS), etc.]

- **Regulatory Issues**
  Uses of available data
  Scope and focus of site investigation
  Application of RCRA vs CERCLA authorities
  Other regulatory issues
  Management of investigation-derived wastes (IDWs)
  Land use issues and risk assessment scenarios
  ARARs

- **Community Relations (Public Participation) Issues**
  Facility Community Relations Plan
  Preliminary Project Community Relations Plan
  Issues of concern

- **Logistics and Other Constraints**
  Operational constraints (active site)
  Use of site services
  Labor agreements
  Compliance agreement constraints
  Procurement issues (subcontractors)
  Facility transfers

- **Responsibilities and Authorities**
  DOE responsibilities
  Contractor responsibilities
  Authorities

- **Project Schedule**
  Major deliverables
  Public meetings

<u>Note A</u>.

<u>Project Management Approach Meetings</u>. Communication within the internal project team (DOE and its contractors) and with the extended project team is critical to developing and reaching a consensus on a project management approach. The project management approach may be developed through a series of internal and extended project team meetings. Ultimately, the agreed upon approach is presented by the extended project team to the stakeholders at a public meeting. The following attendance list provides suggested attendees and agenda topics.

<u>Internal Kickoff Meeting</u>. Attendees are technical, management, and contracting staff who represent DOE and its contractors. The attendees should have direct responsibility for conducting, managing, or administering the project and have authority to settle project-level issues.

<u>Suggested Attendees</u>

- **DOE OU Manager—**the person responsible for RI/FS project management
- **DOE Line Manager**–the line person who oversees the OU manager
- **DOE Contracting Officer—**the person responsible for procurement, contract oversight, and obligation of funds
- **Contractor's RI/FS Project Manager—**the manager responsible for the technical work on the RI/FS project
- **Contractor's RI/FS Task Leaders—**the persons responsible for the work done on separate RI/FS tasks (project planning, community relations, data evaluation, risk assessment, ARARs, etc.)
- **Site Expert—**DOE or contractor who is knowledgeable of and familiar with the waste site and facility history

<u>Extended Project Team Meetings</u>. The extended project team consists of the internal project team, EPA and State regulatory staff, public interest groups that have decisionmaking authority, and others with direct technical expertise or a significant stake in the project result. The extended project team will form the core group (internal and external) that will interact throughout the project.

<u>Suggested Attendees</u>

DOE staff with direct responsibility and authority for the project

- OU project manager
- OU project manager's line manager (if appropriate)

Contractor personnel conducting the RI/FS

- Project manager
- RI/FS task leaders
- Key technical staff (hydrologist, risk assessment leader)

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EPA and state staff with direct oversight of the project

- EPA Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and/or Federal Facilities staff
- State RCRA and/or CERCLA staff

Others with direct technical expertise or stake in outcome

- Site-knowledgeable DOE and contractor staff (including M&O contractor, if appropriate)
- Natural Resources Trustee

<u>Other Potential Attendees</u>

Public Interests

- Local site interest groups and officials
- National and regional environmental groups with expressed interest in the project
- Indian tribes

<u>Stakeholder Meetings</u>. Stakeholders are defined as any person or group that is interested in or affected by a project. Public participation is an essential part of an RI/FS project. The primary objective of the stakeholders meeting(s) is to keep local residents informed and abreast of developments, while allowing opportunity for questions and input. Submodule 1.1, Note B, discusses public participation strategy.

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Note B. **Public Participation Strategy**. The DOE project manager or designee should conduct a strategic analysis of the need for and implications of developing a project-specific public participation plan as part of the initial strategy. A process for conducting a strategic analysis is shown in the Public Participation Strategic Analysis Checklist that follows. The strategic analysis lays out the steps in the decisionmaking process, clarifies the decisionmaking structure, identifies decisionmakers, and determines whether and how to proceed with public participation planning. The public participation plan identifies key issues and stakeholders and the likely degree of controversy. It specifies the objectives of public participation and the information exchanges that need to occur at each step of the decisionmaking process. The strategic analysis should be conducted before convening a stakeholder's meeting that involves the general public.

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Public Participation Strategic Analysis Checklist

- Clarify the decision and draft a decision statement.
- Outline the background of the program/project (including the impetus for the decision).
- Lay out the steps of the decisionmaking process and determine where you are in the process.
    - Define the problem
    - Identify alternatives
    - Establish evaluation criteria
    - Evaluate alternatives
    - Select preferred alternative
- Clarify the decisionmaking structure and identify the decisionmakers.
- Determine whether the decision needs public/stakeholder participation.
- Decide whether to prepare a public participation plan. A major consideration is whether the decision may involve controversy or interest. Example questions are as follows:
    - Will the decision have significant impacts?
    - Will the decision affect certain people more than others?
    - Does the decision involve a topic that is already controversial?
    - Does significant disagreement exist about the technical basis for the decision?
    - Does the decision involve values or is it purely technical? If the decision involves values, does disagreement exist about which values should be given priority?
    - Does the decision have the potential to affect public or worker health and safety?
- Identify people who need to be consulted or included in decisions about public/stakeholder participation.
- Identify constraints and special circumstances that add difficulty to effective public/stakeholder participation.
- Determine how to proceed with public participation planning.
- Determine who should be on the public participation planning team.

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Note B. **Public Participation Strategy (continued)**. A sitewide DOE public participation plan [equivalent to an EPA Community Relations Plan (CRP)] may already exist. However, OU-specific public participation plans may be appropriate where a high degree of controversy is expected or where significant community interest is likely to arise. The OU-specific plan does not need to be detailed, but it should systematically address the topics in the Public Participation Plan Checklist that follows. The OU-specific plan, if required, should be developed in preliminary form and presented during the stakeholder meeting. Stakeholder input should be solicited prior to finalization.

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Public Participation Plan Checklist

- Identify the planning team.
- Identify issues and public participants/stakeholders for each step of the decisionmaking process.
- Determine the level of participation for each stakeholder.
- Assess the level of controversy/interest.
- Identify circumstances that would affect participation strategies.
- Identify desired objectives of the public/stakeholder participation effort for each step in the decisionmaking process.
  - Define the problem
  - Identify alternatives
  - Establish evaluation criteria
  - Evaluate alternatives
  - Select preferred alternative
- Assess the type of participation needed to achieve the objectives and the implications of meeting these needs.
- Identify the information exchanges that need to take place at each step of the decisionmaking process.
- Identify special circumstances that could affect the selection of public participation techniques.
- Select specific public participation techniques.
- Prepare a public participation plan and review it with stakeholders.

Submodule 1.2 Site Understanding

Scoping	
1.1	Project Management Approach
1.2	Site Understanding
1.3	Initial Evaluation
1.4	Data Collection Plan
1.5	Work Plan Preparation

1.2 Site Understanding
• Collection and Evaluation of Available Data
• Development of Conceptual Site Model
• Use of Limited Field Investigations
• Stakeholder Meeting

Submodule 1.2 Site Understanding

Background

Development of a site conceptual model is one of the fundamental steps of the RI/FS process. The conceptual model is used throughout the project to communicate site understanding. It is refined after each data collection or evaluation phase. The conceptual model is a focal point of the project and an essential tool in developing a consensus between the extended project team and the stakeholders about site conditions and problems.

Organization

Submodule 1.2 discusses the following:

- Collection and Evaluation of Available Data
- Development of Conceptual Site Model
- Use of Limited Field Investigations
- Stakeholder Meeting

In addition, more detailed information is provided in the following notes:

- Note A−Site Visit Checklist
- Note B−Organization of Available Data
- Note C−Example Conceptual Model

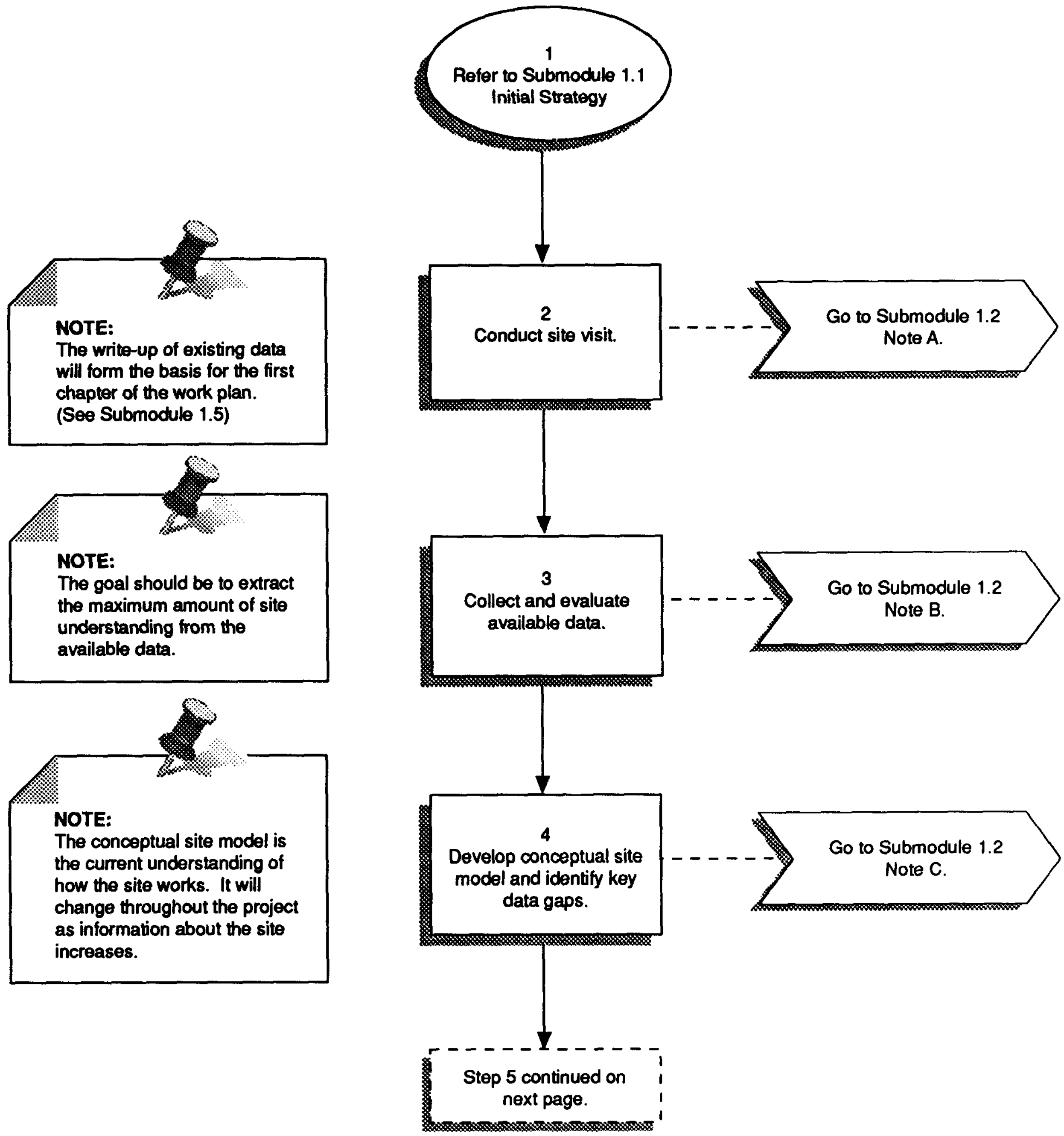
Sources

1. U.S. DOE, January 1991, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-08, Draft A.

2. U.S. EPA, March 1987, *Data Quality Objectives for Remedial Response Activities*, EPA/540/G87/003, OSWER Directive 9335.0-7B.

3. U.S. EPA, October 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA,* Interim Final, EPA/540/G89/004, OSWER Directive 9356.3-01.

Submodule 1.2 Site Understanding



Step 1. Refer to Submodule 1.1, Project Management Approach.

Step 2. **Conduct site visit.** The DOE project team (and extended project team, if appropriate) should visit the waste site to assist discussion of facility history and waste units, and to help increase understanding of the site and logistical issues. See Submodule 1.2, Note A, for additional detail about items to include in a site visit.

Step 3. **Collect and evaluate available data.** Available data are used to develop the initial awareness of the site conditions and problems and to determine the additional information required to make technically defensible decisions about remedy selection. Maximizing the use of available data will lead to more efficient expenditure of resources by avoiding duplication of previous data collection efforts and by helping to focus data collection efforts.

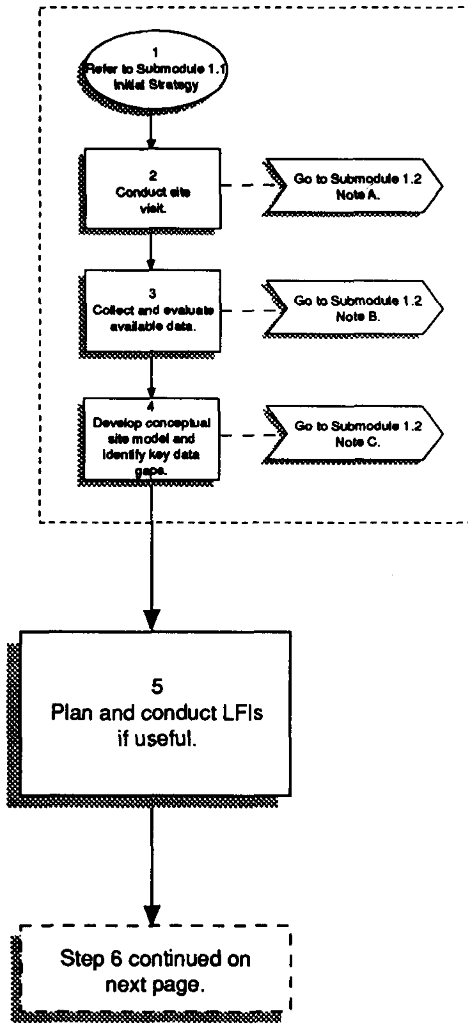
Insufficient collection and interpretation of available data often result in RIs that are overextended and ineffective. *The goal should be to extract the maximum amount of site understanding from the available data.*

Site data most often are scattered in a variety of reports, studies, databases, and files. For most waste sites, the available data and historical information have never been compiled, organized, or presented in the complete and coherent manner needed for an RI/FS. A detailed site history can be particularly useful in later steps of the RI/FS process. Such compilation, organization, and presentation can facilitate the RI/FS process by achieving maximum access to and use of available data.

The site understanding will be reviewed and reused by the extended project team and will constitute Chapter 2 of the work plan. See Submodule 1.2, Note B, for an example organization. The site understanding can be placed directly into the work plan if it is initially developed in such a format. (See Submodule 1.5, Note A, for an example work plan format.)

Step 4. **Develop conceptual site model and identify key data gaps.** The conceptual site model is a combination of descriptive text, source-pathway-receptor diagrams, and conceptual diagrams that together provide a qualitative understanding of how a site works. The conceptual site model should provide the best possible description of the (1) nature and extent of contamination, (2) waste site physical setting, (3) geology and hydrology, (4) geochemistry, (5) fate and transport mechanisms, (6) contaminant pathways, and (7) receptors. The conceptual site model should reflect both known conditions and uncertainties. Submodule 1.2, Note C, provides an example conceptual site model.

The conceptual site model is a powerful tool to help identify data gaps. A critical data gap in the conceptual site model is any significant uncertainty in the interconnections between the contaminant sources and releases, fate and transport, current nature and extent, and driving forces and pathways to receptors. The conceptual site model explicitly represents these interconnections. A significant uncertainty in the conceptual site model occurs when it cannot adequately support the three major activities of the RI/FS process: (1) risk assessment, (2) ARARs determination and evaluation, and (3) development and evaluation of remedial alternatives.



NOTE:
LFIs address key data gaps for
- Focusing the work plan
- Pursuing an accelerated action
- Eliminating historical release sites from further consideration

The significant data gaps in the conceptual site model represent potential data needs. The significance of each data gap should be evaluated to determine whether the uncertainty is acceptable and can be managed or whether additional data will have to be collected. See Module 7, SAFER for more information about managing uncertainty during an RI/FS.

Uncertainty will always be a part of formulating a conceptual site model. Managing uncertainty should start with the development of the conceptual site model. Three fundamentals about uncertainty in waste site investigations are as follows:

- Uncertainty in understanding how a waste site works is inevitable, but complete understanding of site conditions is unnecessary. The only necessity is to understand site conditions sufficiently to complete the baseline risk assessment and ARARs determinations, and to develop and evaluate remedial alternatives.

- Uncertainty can be reduced to a limited extent by remedial investigation. Investigations to reduce uncertainty need to be balanced with available resources and focused on gathering information to manage any remaining uncertainties.

- The extended project team needs to reach agreement on the level of uncertainty that is considered manageable. One decision to make is whether it is less expensive to manage uncertainty during later stages of the RI/FS, or to reduce uncertainty by collecting more data. The levels of uncertainty derived from data collection can often be quantified to provide criteria for the data collection approach.

Ecological risk assessment is an aspect of site understanding that often is underscoped. Several ecological risk activities should begin at this time, including identifying ecological pathways and receptors that may require further study and assembling ecological risk specialists (see Submodule 2.4, Note B).

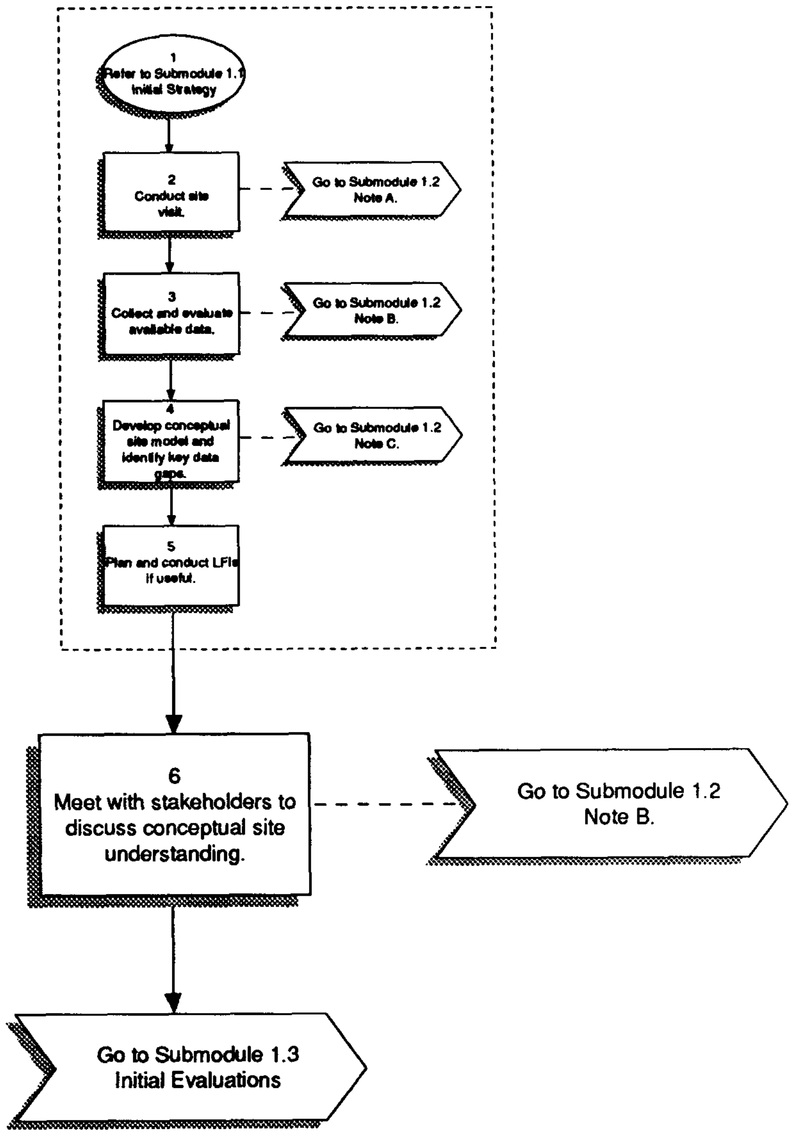
Step 5. **Plan and conduct LFIs if useful.** A limited field investigation (LFI) is a short-term, focused data collection and analysis effort. LFIs can be used to address significant gaps in the conceptual site model, even as early as the scoping phase. Data gathered through an LFI can be used to focus the RI or to pursue early actions, such as expedited response actions.

Examples of common data gaps that can be addressed by LFIs are (1) uncertainties in physical site conditions, including direction of groundwater flow, location of waste units, extent of contamination, and affected media; and (2) types and levels of contaminants.

Following the NCP's preference of a bias for action, LFIs can be used to support accelerated actions. An accelerated action can be a removal action or interim remedial action that is performed before development of a full-scale RI/FS. LFIs can be used to resolve (1) relatively small uncertainties in site conditions so that an accelerated action can proceed or (2) regulatory issues that may hinder an accelerated action (e.g., whether a waste is a RCRA hazardous waste).

The data collected and analyzed through the LFI are also used to refine the conceptual site model. As the conceptual site model is updated with the new information, the data gaps, significant uncertainties, and site understanding will change and directly influence future

Submodule 1.2 Site Understanding (cont.)



data gathering activities. LFIs also can eliminate some historical release sites that were identified in error.

For efficient implementation, LFIs require planning similar in format to the RI/FS work plan, but with less detail. Compliance agreements may have specific implementation requirements for field investigations and should be consulted. (DOE will develop future guidance on LFIs.)

Step 6. **Meet with stakeholders to discuss conceptual site understanding.** The purpose of the meeting is for the extended project team to present to the stakeholders the improved site understanding that was developed after gathering and evaluating the available data (see Step 3) and to explain how this improved site understanding will be used in developing the RI/FS work plan.

The focus of this stakeholders meeting is to develop a common understanding of the problem and proposed approach. Two key agenda items are discussion of technical issues and identification of stakeholder issues and concerns. The agenda should be developed to encourage discussion of the conceptual site model and how the project strategy will reduce critical uncertainties in the conceptual site model. The meeting should include a technical presentation of the current site understanding, the initial strategy for addressing key data gaps, and a list of uncertainties that have been identified as manageable. Technical project staff should direct the presentation, but the extended project team should be present.

Meeting at this point in the scoping process allows the focus to be placed on developing a common understanding of the problem. This meeting continues the work of developing an explanation of the site background and setting (Chapter 2 of the work plan)–see Submodule 1.2, Note B for example organization. After this meeting, the contents and main points of site background and setting should be a matter of general agreement among the stakeholders. After completing the steps in Submodule 1.3, Initial Evaluations, the next logical meeting will encompass a full agenda: risk assessment approach, probable ARARs, remedial action objectives (RAOs), need for treatability studies, and community relations issues.

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<u>Note A</u>. **<u>Site Visit Checklist</u>**. Visits to waste sites at DOE facilities are important to developing site understanding. The DOE project manager or designee is responsible for coordination of the site visit. Visits to DOE waste sites are often complicated by the continuing operations, security issues, health and safety requirements, and transportation logistics.

The site visit primarily benefits the technical (DOE and contractor) staff that will prepare the RI/FS work plan. If the various site restrictions can be reconciled, the extended project team also could be invited. The site visit will serve as useful background in all future interactions with the regulators.

Checklist

- Site Access: Coordination should be with the operations contractor. Specific attention should be given to access limitations (e.g., roads to waste sites, walking required, radiation zones).

- Security: Facility security requirements for visitors need to be determined for the specific location of the waste site. Example requirements include U.S. citizenship, escort protocol (number of visitors per escort), and time required for processing. The security office should be contacted for specific actions.

- Health and Safety: Specific health and safety requirements may exist for the DOE facility and for a visit to the specific waste site. Some issues may include requirements for a briefing, special equipment, radiation training, or medical monitoring. The facility health and safety staff should be consulted.

- Transportation: Confirm that an adequate number of vehicles and qualified drivers are available and have been reserved.

- Site Briefing: Before the site visit, a brief technical presentation outlining waste site history and other pertinent facts is useful for maximizing the benefits of visiting the site. Site-knowledgeable staff (the DOE OU project manager or operations contractor staff) are the best choice for this briefing. Information should include location (site map), operations history, waste site history, and current status.

  In addition to the site briefing, a site-knowledgeable person could be included in the visit. Useful information can be gathered during informal question and answer sessions between the site-knowledgeable person and the staff that will perform the work.

Note B: Example Organization of Available Data

2.0 OPERABLE UNIT BACKGROUND AND SETTING
- 2.1 Operable Unit Site Description
  - 2.1.1 Location
  - 2.1.2 History of Operations
  - 2.1.3 Facility Identification
  - 2.1.4 Waste-Generating Processes
  - 2.1.5 Interactions with Other Operable Units
  - 2.1.6 RCRA Site Interactions
- 2.2 Physical Setting
  - 2.2.1 Topography
  - 2.2.2 Geology
  - 2.2.3 Geohydrology
  - 2.2.4 Surface Water Hydrology
  - 2.2.5 Meteorology
  - 2.2.6 Environmental Resources
  - 2.2.7 Human Resources
- 2.3 Known and Suspected Contamination
  - 2.3.1 Sources
  - 2.3.2 Soil
  - 2.3.3 Groundwater
  - 2.3.4 Surface Water and River Sediment
  - 2.3.5 Air
  - 2.3.6 Biota
- 2.4 Conceptual Site Model
  - 2.4.1 Sources
  - 2.4.2 Pathways
  - 2.4.3 Receptors
  - 2.4.4 Uncertainties

Note B. **Organization of Available Data.** Organization of available data in written chronologies, for the waste site or for each waste-generating process and disposal unit, is helpful in establishing the waste site history and probable conditions. Historical information needs to be organized to determine (1) what is known, (2) contradictions in what is known (uncertainties), and (3) what is not known. For example, often, the exact locations of waste units are not known. The data presentation should be concise and should clearly detail what is and is not known.

Types of Available Data

- Data pertaining to activities, operations, processes, and hazardous substances used
- Data pertaining to past waste management and disposal practices
- Data relating to the types and quantities of hazardous substances present in the environment, including previous sampling results
- Data pertaining to environmental site conditions and migration potential
- Demographic and land-use information
- Historical and aerial photographs

Sources of Available Data

- Present and past site users, operators, and employees
- Local land records and deed books
- Representatives from Soil Conservation Service and USGS, well drilling companies, etc.
- Local meteorological monitoring station
- Monitoring data
- Annual environmental surveillance reports

Available data will vary in quality and usability; these data often can be separated into three categories:

- High-quality data for direct use in the RI/FS
- Low-quality data for use in scoping and assessing the general nature and extent of contamination
- Poor-quality data that are not valid or not representative of site conditions (e.g., dated groundwater conditions)

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The compliance agreement may specify how to determine data usability on the basis of quality. Factors to consider in categorizing available data quality include comparability, analytic methods and laboratories, detection limits, and sample collection and handling methods. Regardless of data quality or the constraints placed on their use (e.g., compliance agreement constraints), nearly all information is helpful in formulating the initial site understanding and developing the conceptual model.

The goal of evaluating available data is to extract maximum site understanding. Superficial data evaluation generally results in missed opportunities to better understand the waste site and to focus the investigation. The available data should be evaluated thoroughly for indications about the likely nature and extent of contamination, including waste sources, migration pathways, and human and environmental receptors.

Effective data presentation is important for maximizing data evaluation. Common presentation techniques include the following:

- Text: Descriptions of waste generation and management practices
- Maps: Locations of structures and waste management units, contours of contaminant distribution and water table elevation, preliminary identification of migration barriers
- Conceptual drawings: Cross-section and fence diagrams, contaminant distribution beneath waste sites
- Graphs: Time plots of groundwater data, sampling at depth results
- Tables: Waste inventories

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Note C. **Example Conceptual Site Model.** A conceptual model should provide a current, integrated summary of what is known, unknown, probable, and improbable about how the site works. This may best be accomplished by using a combination of text, source-pathway-receptor diagrams, and conceptual cross-sections.

This example conceptual model is an excerpt from a draft work plan for the Hanford Site. The 100-BC Area at Hanford includes the B Reactor area and the C Reactor area. The surface sources and facilities have been divided into four OUs (100-BC-1, 100-BC-2, 100-BC-3, and 100-BC-4). The groundwater beneath the entire 100-BC Area is OU 100-BC-5. This excerpt is from a draft version of the 100-BC-5 RI/FS work plan. Its use is illustrative of how to develop a conceptual model and should not be interpreted as activities currently under way in the 100-BC Area at Hanford.

Considerable amounts of historical and sampling data were available for this OU; such availability is atypical. Although the amount of information is atypical, this example well illustrates maximum use of available data in establishing an initial site understanding. Any data gaps are immediately obvious when a conceptual model is constructed at this level of detail.

The conceptual model was developed in 3 days. One day of staff time was spent interpreting the data and constructing the initial model. A 1-day technical meeting with Hanford Site personnel was spent presenting the initial model and making changes. One day was spent finalizing the model and developing the graphics. This example is an unedited version as it appeared in the draft work plan (U.S. DOE, January 1991, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-08, Draft A).

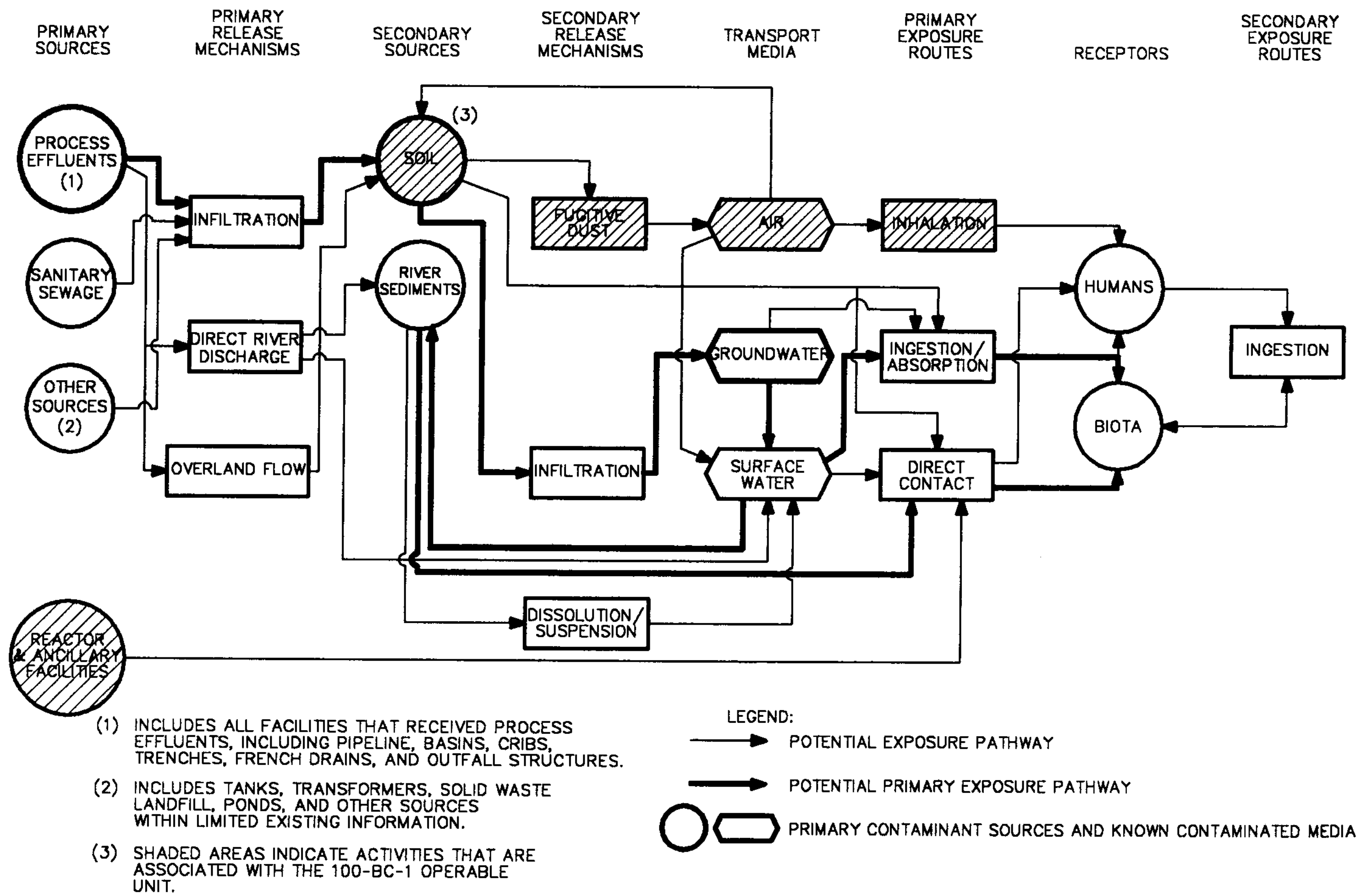

Figure 3-13. Site Risk Assessment Pathway Conceptual Model - Contaminant Sources, Release Mechanisms, Environmental Transport Pathways and Potential Receptors.

3.1.7 Site Conceptual Model

The data and evaluations discussed previously are integrated and summarized in the form of a preliminary site conceptual model in this section. The site conceptual model is preliminary because the data are not complete, not all the data have been evaluated, and in most cases the data are not validated.

The two-fold purpose of the site conceptual model is to focus the RI/FS process and to provide a basis for the initial risk assessment. A lot of data are available, but as stated previously, have limited use. Further, these data were generally collected for other purposes and, therefore, may not be ideally suited for the RI/FS process. The site conceptual model is shown schematically in Figure 3-13. Summarized in this schematic are the contaminant sources, mechanisms for these contaminants to be released into other environmental media, and potential pathways and receptors. This schematic, together with estimates of key parameters such as contaminant concentrations, is part of the basis for modeling the initial human risks associated with the various contaminants, pathways, and receptors.

The conceptual model is used to express qualitatively the best current estimates or understandings of the following information.

The conceptual model should be very straight-forward about the data that are available and unavailable, and in explaining when inter-pretations and inferences are being made on the basis of available data.

- The spatial distribution of contaminants in the groundwater system. Available data are very limited and, with one exception (the deep B3-2 P and Q wells), are limited to the upper Hanford formation.

- Pathways contaminants may follow to potential receptors. This is based on the integration of contaminant, hydrodynamic, hydrogeologic, and geologic data. Inferences are made on relatively sparse and unevenly distributed data.

- Contaminant sources. Most of the data for source location is for the upper 20 ft (6 m) of the vadose zone. Inference is made to the presence of contaminants near the unconfined water table based on groundwater contamination, historic records of water levels, type of waste disposed (liquid), and groundwater temperature data.

- The hydrogeologic system. This is based on the integration of hydrodynamic, hydrogeologic, and geologic data. The data are sparse and unevenly distributed on the 100-BC-5 operable unit; however, there are a lot of data on the Hanford Site in general, from which inferences are made.

- Barriers to contaminant transport. This is based on the integration of contaminant, hydrodynamic, hydrogeologic, and geologic data. The data are sparse and unevenly distributed on the 100-BC-5 operable unit; however, there

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are a lot of data on the Hanford Site in general, from which inferences are made.

- The interaction of groundwater with surface water and sediment. Investigations downstream of the 100 Areas indicate that contaminants that reach the Columbia River are diluted to below ARARs or detection limits. There are no data on surface water and sediment contamination adjacent to the 100-B/C Area.

- Effects on biota. Much work has been done on the Hanford Site in general but little at the 100-BC-5 operable unit.

Key aspects of the site conceptual model are summarized and illustrated as follows.

Probable sources.

3.1.7.1 Sources. The primary sources of contaminants that have affected and potentially still affect groundwater in the 100-BC-5 operable unit are located in the 100-BC-1, 100-BC-2, 100-BC-3, and 100-BC-4 operable units. Although the sources are numerous, the primary known sources of groundwater contamination are the following:

- The cooling water retention basins (116-B-11 and 116-C-5), associated pipelines, and disposal trenches in the northern portion of the 100-B/C Area (in the 100-BC-1 source operable unit)

- The demolished tritium facility and associated liquid waste disposal crib (116-B-5) and French drain near the central portion of the area (in the 100-BC-1 source operable unit)

- The pluto crib and decontamination liquid waste disposal cribs in the vicinity of the B Reactor buildings (in the 100-BC-1 source operable unit)

- The pluto crib and sand filter east of C Reactor (in the 100-BC-2 source operable unit)

Other potential sources of groundwater contamination that are considered less significant, based on the current knowledge of the site, are the radioactive and nonradioactive solid waste disposal sites and the septic tanks and associated leachfields.

Relative importance of the sources.

The 100-BC-1 operable unit contains the following significant sources. The sludge that remains in the 116-B-11 and 116-C-5 retention basins constitutes the most significant source in terms of the mass of radiological contamination that remains in the soil at the 100-B/C Area. The largest concentrations of beta-gamma radiation at the 100-B/C Area also occur in the B and C retention basin sludge, the retention basin fill soil, the soil beneath the basins, and the scale and sludge that remain in the cooling water

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effluent pipelines. The primary source of tritium contamination is the 116-B-5 crib located just north of the site of the former 108 Building (the tritium facility). Radiological contamination has been shown to extend to a depth of at least 20 ft (6 m) beneath most of the waste disposal sources sampled. The 100-BC-1 operable unit is the largest source operable unit in the 100-BC-5 operable unit on the basis of surface area (see Figure 1-2) and volume of waste disposed. Practices in the 100-BC-1 operable unit are believed to have led to much of the existing groundwater contamination in the 100-BC-5 operable unit. However, other source operable units may have contributed significantly to groundwater contamination. One example is the pluto crib in the 100-BC-2 operable unit. It is not a goal of the 100-BC-5 operable unit RI/FS to determine which source operable unit contributed more or less to groundwater contamination. However, source information will be required to effectively screen remedial alternatives in the feasibility study stage of the RI/FS. The 100-BC-5 RI/FS will integrate and screen potential contaminant sources from all operable units outside of 100-BC-1. The 100-BC-1 RI/FS will be conducted concurrently with the 100-BC-5 RI/FS.

Major data gap.

Information on nonradiological contamination at the site is sketchy and is limited primarily to information on the chemicals used at the site and groundwater sampling data. Large volumes of sodium dichromate were added to the cooling water to inhibit corrosion of the cooling water system in the reactor. Also, chromic acid was used as a decontamination solution in the reactor. Thus, it is assumed that the main sources of chromium at the site are associated with the cooling water effluent facilities, particularly the sludge in the basins and pipelines, and the soils beneath these facilities and the decontamination cribs located near the B Reactor building. The source of nitrate, which has been detected in groundwater in the 100-B/C Area and vicinity, is assumed to be from the nitric acid used for decontamination procedures.

Where few data are available, historical information on operations may indicate reasonable assumptions.

Another source of contaminants is contaminated groundwater in low permeability material and in dead-end pore space within the aquifer and contaminated groundwater from other locations on the Hanford Site. Diffusion of contaminants out of the pore space is believed to be slow, but perhaps long term. Understanding the magnitude and rate of release from dead-end pores may affect remedial alternative screening and selection. Understanding the nature and extent of contaminants in groundwater flowing into the 100-B/C Area may also affect remedial alternative screening and selection.

3.1.7.2 Groundwater System. Key elements of the conceptualization of the hydrogeologic system are as follows.

Probable conditions of the groundwater system.

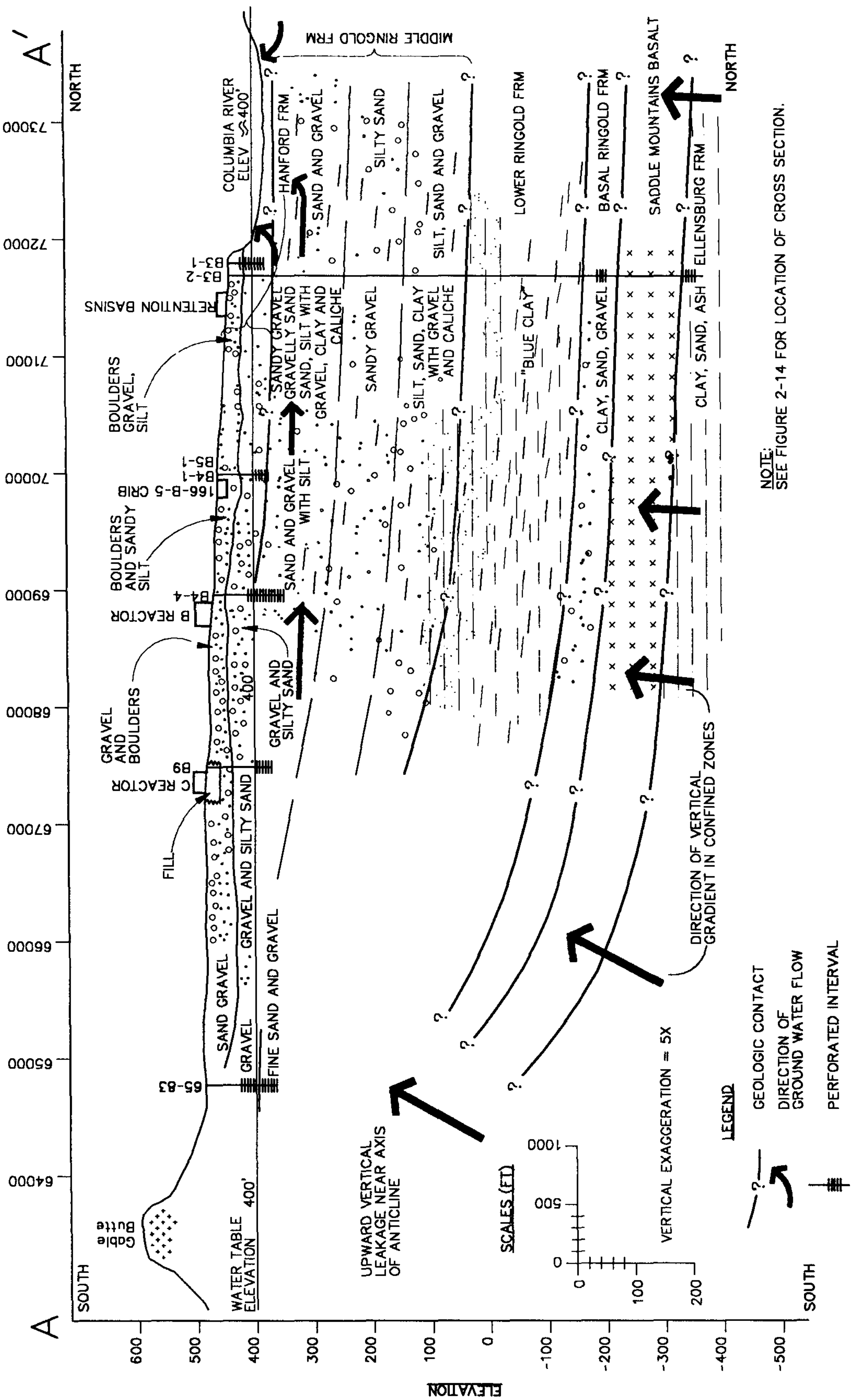

Figure 3-14. Conceptual Model of Hydrogeologic System at 100-B/C Area.

- The upper portion of the unconfined aquifer has been contaminated with various radionuclides, nitrates, and chromium by operations at the 100-B/C Area.

- The regional vertical hydraulic gradient between the basal Ringold unit (confined) and the unconfined aquifer is upward (see Section 2.2.3.2.2).

- The sediments of the Ringold Formation are stratified, resulting in impediments to vertical groundwater flow and contaminant movement.

- The shallow aquifer is hydraulically connected with the Columbia River. Changes in stage in the river, due to variations in discharge from the Priest Rapids pool, directly affect the direction and rate of groundwater flow beneath the 100-B/C Area.

The hydrogeologic system in the 100-BC-5 operable unit is conceptualized as being layered with strata of coarse- and fine-grained sediments, overlying basalt. The significance of the stratification is that vertical groundwater movement and contaminant transport are largely controlled by the nature and extent of the various strata in conjunction with the direction and magnitude of the vertical hydraulic gradient. The initial conceptualization of the hydrogeologic system in profile is illustrated in Figure 3-14. Descriptions of the key hydrogeologic elements of the site conceptual model follow.

3.1.7.2.1 Unconfined Aquifer. In the initial site conceptual model, the unconfined aquifer consists of saturated sediments in the Ringold Formation, although the top of the aquifer may locally extend upward into the lower Hanford formation. The base of the unconfined aquifer is marked by a gradational contact between sands and gravels of the middle Ringold Formation and finer sand silts and clays of the lower Ringold Formation. The lower Ringold is locally referred to as the "blue clay." Groundwater may occur under semiconfined conditions in deeper portions of the middle Ringold Formation because of the interlayering of relatively fine and coarse strata.

In very general terms, the direction of groundwater flow is northward toward the river. The hydraulic gradient is very low (on the order of 10^{-4} ft/ft) but steepens near the river due to the effect of stage fluctuations. The elevation of the water table is generally around 400 ft (123 m), using National Geodetic Vertical Datum, beneath the 100-B/C Area. Water levels in the unconfined aquifer fluctuate daily in response to changes in river stage and with seasonal changes in recharge (see Section 2.2.3.2.3). The impact of fluctuations on groundwater levels decreases inland from the river. Because of the hydraulic effects of the river, the direction and rate of groundwater flow at any time is difficult to predict without a direct simultaneous measurement of groundwater elevations.

The best and most complete possible model for how the site "works" is developed on the basis of the available data.

The significance of physical features of the site to contaminant fate and transport.

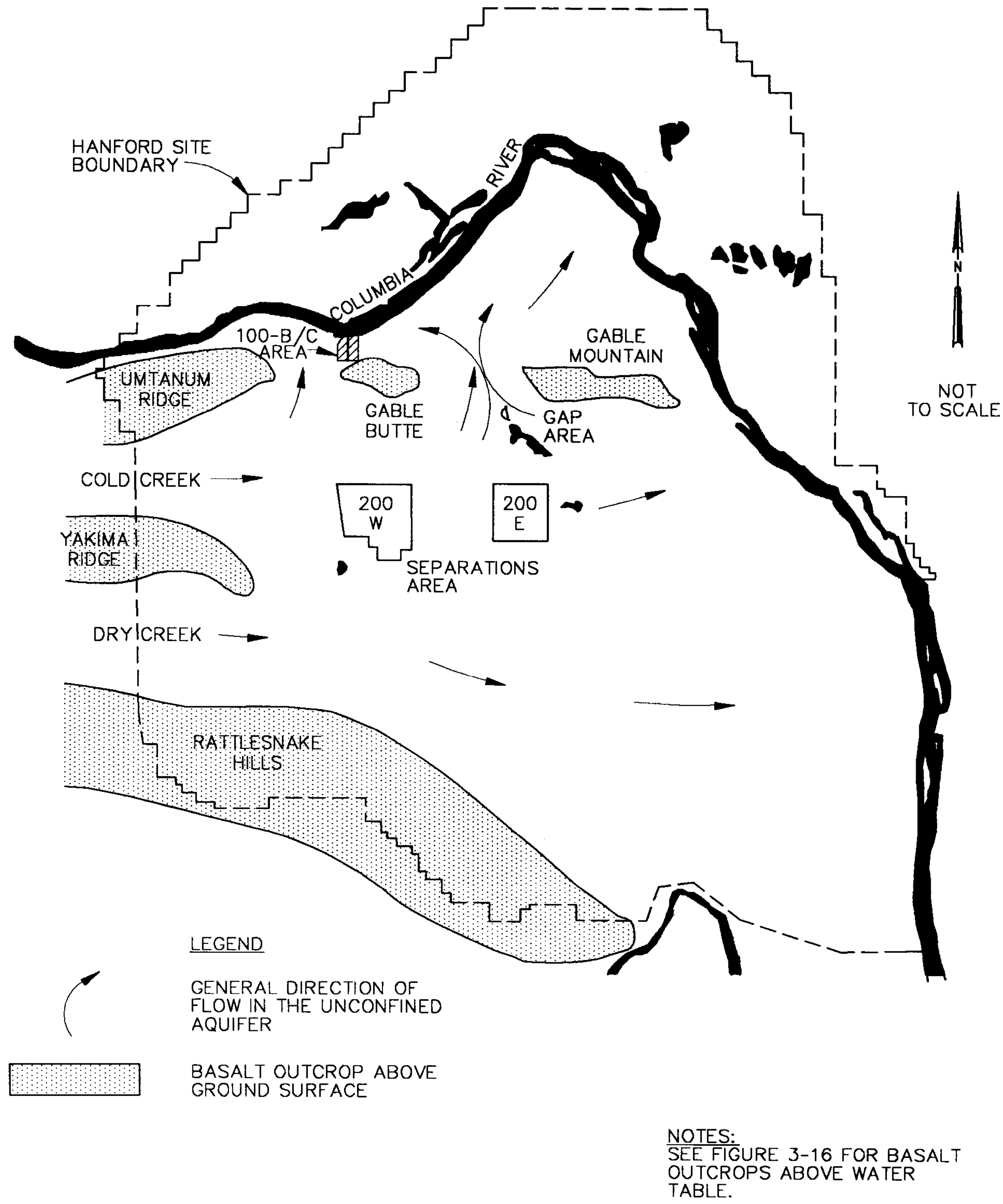

Figure 3-15. Generalized Groundwater Flow Directions in the Unconfined Aquifer in the Vicinity of the 100-BC Area.

The unconfined aquifer receives local recharge from the limited precipitation infiltrating across the site, from the Columbia River, and also, perhaps, from upward flow of groundwater from the deep basalt units. Recharge from the basalts may be occurring near the Gable Butte anticline because there is an upward hydraulic gradient and there is potential for enhanced vertical connection between the unconsolidated sediments and the deeper basalt units via fracturing. The confining units in the unconsolidated sediments (e.g., the blue clay in the lower Ringold Formation) pinch out near the anticline.

The basalts of the Gable Butte-Gable Mountain anticline create an impediment to horizontal groundwater flow in the unconfined aquifer where they are at elevations above the unconfined aquifer water level elevation. This occurs south of the 100-B/C Area where Gable Butte creates a groundwater divide in the unconfined aquifer. In Gable Gap (see Figure 3-15 and 3-16), between Gable Mountain and Gable Butte, the basalts do not rise above the water level in the unconfined aquifer. Unconfined groundwater may flow laterally from the separations areas toward the 100-B/C Area and vicinity through Gable Gap and west of Gable Butte (see Figure 3-15). The target analytes for groundwater sampling at 100-BC-5 should include known and potential contaminants in groundwater beneath the separations area.

Eight monitoring wells are completed in the upper saturated zone to provide monitoring of waste and contaminant levels in the unconfined aquifer. Contaminants attributed to 100-B/C Area mission (e.g., tritium, ^{137}Cs, nitrate, chromium, or ^{90}Sr) have been detected at various concentration levels in all of the monitoring wells (see Section 3.1.3 for additional details).

The upper saturated sediments are variable but generally consists of sandy gravel, gravelly sand, and cobbles and boulders and is believed to be very permeable, with hydraulic conductivity on the order of 10 to 1,000 ft/day (3 to 330 m/day). These sediments are members of either the Hanford or middle Ringold formations. The upper Ringold Formation appears to be missing and the Hanford formation lies unconformable on middle Ringold. Because of stratification within the Ringold Formation, groundwater will tend to move horizontally, parallel to bedding. Discharges of cooling water and liquid wastes to the surface of the aquifer would have entered the groundwater system and spread laterally away from the sources toward eventual discharge to the Columbia River. Monitoring efforts should concentrate on zones of relatively high permeability in the upper portion of the unconfined system.

Conceptual model development leads directly to ideas about where to look for the most significant contamination.

A silty sand unit identified in the middle Ringold in well 199-B3-2 at a depth of approximately 150 to 250 ft (46 to 76 m) appears to be the uppermost recognizable layer (in terms of thickness) of relatively low permeability (see Figure 2-18). Monitoring immediately above the top of this zone is specified because, conceptually, the relatively low permeability of the unit may impede downward migration of contaminants. The approximate range of hydraulic continuity of this unit is expected to be one to two orders of magnitude less than that of the overlying sediments.

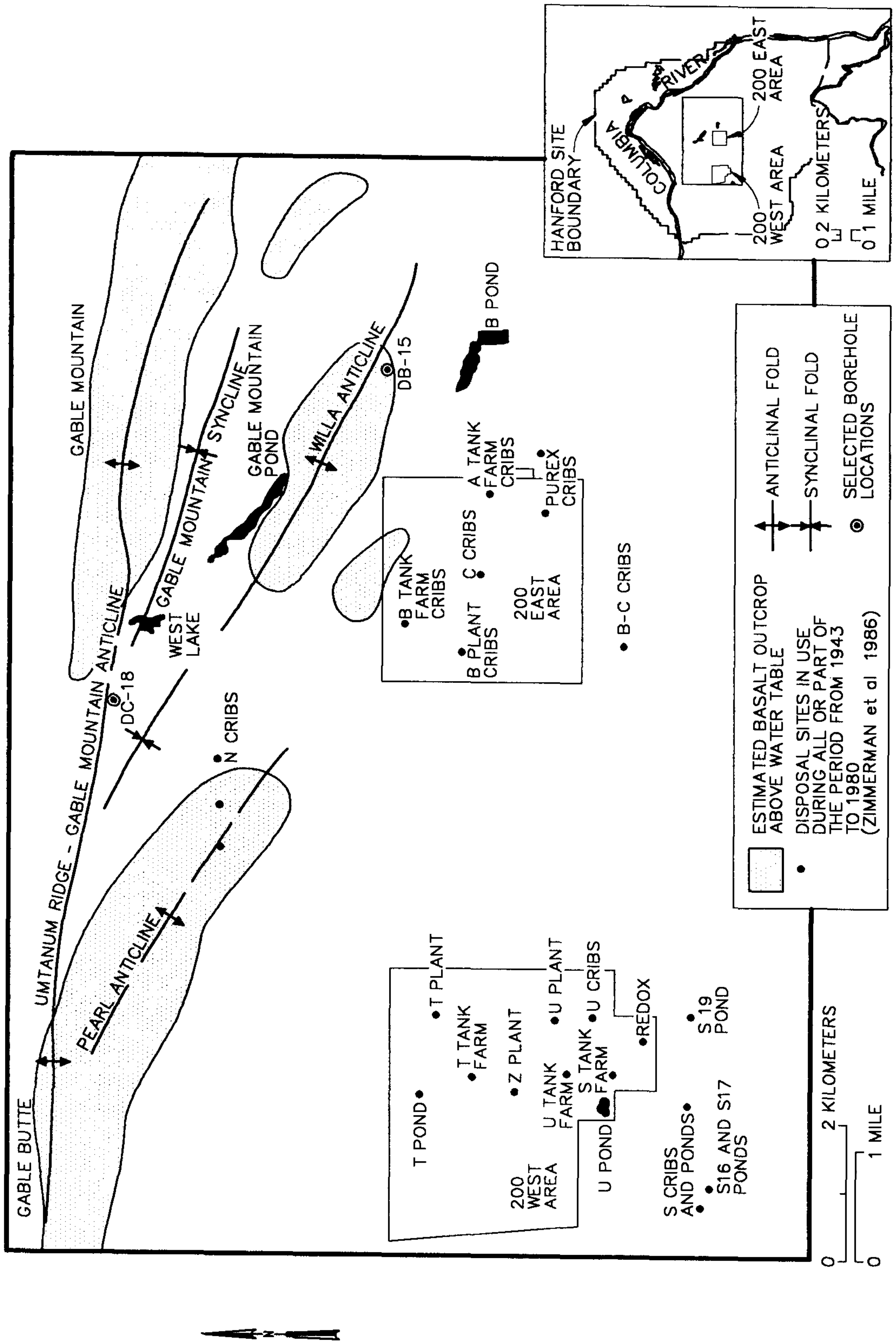

Figure 3-16. Location of Major Structural Features, Basalt Outcrops Above the Water Table, and Past Wastewater Disposal Sites Near the 200 East and 200 West Areas (DOE 1988).

A zone of silt, sand, and gravel lies beneath the silty sand unit (see previous paragraph) approximately between the depths of 250 and 370 ft (76 and 120 m). Conceptually, this zone has a relatively high hydraulic conductivity compared to the adjacent hydrostratigraphic units. A limited number of monitoring wells will be completed in this zone. The blue clay in the lower Ringold encountered in the 199-B3-2 well is believed to be continuous across the 100-B/C Area and vicinity. If so, this unit likely confines the lower aquifer(s). The horizon near the contact of the sands, gravel, and silt of the lower-middle Ringold and the underlying blue clay of the lower Ringold Formation will be monitored for groundwater quality. This horizon is the deepest "permeable" zone above the blue clay (thought to be a significant regional aquitard), and the presence or absence of contaminants in this hydrostratigraphic unit will be important in characterizing the nature and extent of shallow and deeper contamination.	**How a question about the site will be resolved.**
3.1.7.2.2 Confined Aquifer. Below the blue clay unit is the basal Ringold. Samples of the basal Ringold from the 199-B3-2 well were described as clay, sand, and gravel. The basal Ringold in the 100-B/C Area may produce small amounts of water to wells but generally would not be considered an aquifer. An upward hydraulic gradient exists between the lower basal Ringold sediments and the unconfined aquifer based on existing water-level data (see Figure 2-18). The basal Ringold is probably confined by the overlying blue clay. Contaminants from the 100-B/C Area are not expected in the basal Ringold unit because of the following conditions. • There is an upward vertical gradient between the basal Ringold Formation and the overlying unconfined aquifer in the 100-B/C Area. • The blue clay unit of the lower Ringold Formation is conceptually a confining layer that restricts vertical groundwater flow. Groundwater samples from basal Ringold at Well 199-B3-2 indicated tritium at a mean level of about 900 pCi/L, which is above the nominal background tritium concentration in groundwater, given as about 200 pCi/L. If this tritium is related to the contaminants found in the upper saturated Hanford formation in the 100-BC-5 operable unit, then at some point a downward hydraulic gradient had to exist with one or more of the following conditions: • Interconnected fractures or permeable lithologies or a combination of both cross-cutting the blue clay in the lower Ringold Formation • Absence of the blue clay unit in the lower Ringold Formation with more permeable lithologies in its place	**Improbable conditions.**

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- Flaws in the 199-B3-2 well construction that allows or allowed contaminants to flow vertically from the zone of known contamination in the saturated Hanford formation to the basal Ringold Formation.

- Groundwater mounding as a result of effluent releases may have temporarily reversed the upward vertical gradient providing sufficient energy for the downward migration of constituents.

The same rationale applies to the tritium detected in groundwater samples from the Ellensburg Formation at 199-B3-2.

The existing data indicate that an upward hydraulic gradient exists between the lower basal Ringold sediments and upper unconfined aquifer. The potentiometric surface for January 1989 was at 442.6 ft (150 m) in Well 199-B3-2-Q, screened at a depth of 635 to 645 ft (212 to 215 m). Water elevations in the shallow wells (e.g., 199-B4-1) are approximately 400 ft (135 m) for the January 1989 data. However, little hydraulic data are available for the deeper units (e.g., below the saturated Hanford formation). Further, groundwater mounding in the saturated Hanford formation is known to have existed during reactor operations, and in the past may have caused a downward hydraulic gradient.

Basalt flows of the Columbia River Basalt Group and sedimentary interbeds of the Ellensburg Formation lie below the Ringold sediments. Groundwater movement occurs primarily within the brecciated interflow zones and sedimentary interbeds that separate individual basalt flows. The basalt flow interiors are dense, crystalline rock that can be effective aquitards if fracturing is not significant. For this reason and because of the probable existence of upward vertical gradients (from the basalts into the Ringold sediments), contaminants in the basal Ringold (if present) are not expected to migrate downward into the Columbia River Basalt Group. The presence of tritium at Well 199-B3-2 (800 pCi/L) contradicts this conceptual understanding of the site hydrogeology. Explanations for this apparent inconsistency are as follows:

The conceptual model also indicates zones where contamination is unlikely and sampling is unwarranted.

- The contamination results from failed annular seals in the well bore at 199-B3-2.

- The contamination migrated in the deeper zones from other portions of the Hanford Site, perhaps through Gable Gap.

Uncertainties.

- The conceptual understanding of the hydrogeology is inaccurate and deep downward migration of contamination from the 100-B/C Area has occurred.

3.1.7.3 Vadose Zone. The vadose zone consists primarily of sand and gravels of the Hanford formation from ground surface to the water table. Key elements of the conceptualization of the vadose zone include the following.

Probable conditions of the vadose zone.

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• The lithology of the vadose zone is variable but generally consists of sandy gravel, gravelly sand, cobbles, and boulders and is very permeable.	
• The vadose zone has been contaminated with various radionuclides, nitrates, and chromium by the disposal of liquid and solid wastes within the 100-BC-1, -2, -3, and -4 operable units.	
• The surface sources noted above have resulted in the presence of localized, concentrated contamination within the shallow vadose zone soils.	**The pattern of expected contamination.**
• Low permeability silt lenses in this vadose zone may cause lateral spreading of infiltrating liquid wastes.	**Transport mechanisms.**
• Channeling within the vadose zone may enhance lateral contaminant movement.	
• Distribution of contaminants at the capillary zone is widespread as a result of the presence of a relatively thin, but really extensive, groundwater mound, which existed during facility operations.	**This groundwater mound is the key hypothesis of the conceptual model. It was based on a review of historical data and speculation on the fate of contaminants released during operations.**
• Contaminants in the capillary portions of the vadose zone, which are in contact with the top of the water table, may be released to the groundwater through a combination of infiltration from precipitation and water table fluctuations related to fluctuations in the river level.	**The conceptual model should provide explanations or hypotheses about the contamination seen. In this instance, order-of-magnitude fluctuations of tritium in some monitoring wells had to be explained.**
• The majority of contamination in the vadose zone is expected to be beneath the cooling water retention basins and related effluent lines, discharge lines, and outfalls.	**The groundwater mound hypothesis indicated where the residual contamination should be.**
• Contamination beneath smaller sources such as cribs and French drains may not have reached the groundwater table.	

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- Infiltration from precipitation may drive contaminants further into the vadose zone and the water table. Until recently, natural infiltration was believed to be low, on the order of tenths of an inch per year, and perhaps zero some years. Estimates of infiltration for the Hanford Site have recently been revised upward. Measured infiltration parameters from ongoing studies will be used to refine the conceptual model.

The conceptual model will be continually refined.

Most of the contaminants found in the groundwater of the 100-BC-5 operable unit are believed to have been transported to the groundwater table by the large volumes of liquid generated by the various process and cooling water streams active during reactor operation. Contaminants are believed to exist in the unsaturated zone at all elevations. However, most of the contaminants remaining in the saturated zone are believed to be relatively immobile without the driving force of the percolating process and cooling waters characteristic of the period in which the reactors operated. One major exception is the zone immediately above the water table. Contaminants near the water table may be represented as an intermittent source; rising groundwater may dissolve or leach out contaminants that otherwise would only reach the groundwater via infiltrating precipitation or applied surface water.

How the site "works."

3.1.7.4 Surface Water and Sediments. Groundwater from the unconfined aquifer discharges to the Columbia River through springs near river level and as baseflow through the sands and gravels of the Hanford formation. This groundwater contains radionuclides, nitrate, and metal contaminants that exceed drinking water standards. However, because of dilution, drinking water standards are not believed to be exceeded in the Columbia River. Recreational users at a point of groundwater discharge (e.g., springs) would potentially be endangered if the water were ingested prior to being received and diluted by the river, or by direct contact with exposed sediments contaminated by the springs.

Exposure pathways.

Hot springs from the groundwater mound discharged to the river bank during the operations period. These hot springs may have contributed to both sediment and river water contamination.

Historical information.

Contaminants are expected in association with near-shore sediments where groundwater from the 100-B/C Area is discharging to the Columbia River. Deeper river sediments are likely to contain lower contaminant concentrations because of the scouring action of the river. Any threats to the environment or public health from contaminated sediments is probably through the food chain where aquatic plants would uptake contaminants from the sediments and associated groundwater.

3.1.7.5 Aquatic Biota. Although there is little site-specific data on biota in the 100-B/C Area, studies at other 100 Area sites and the ongoing Hanford environmental monitoring provide sufficient information for a general understanding of the biota at the 100-BC-5 operable unit. Potential pathways that would affect biota or create human risk begins with plant uptake of contaminants from sediments or aquatic organism intake of contaminated

Data gaps.

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groundwater as described in Section 3.1.7.4, Surface Water and Sediments. Other potential pathways include resident and visiting wildlife ingestion of vegetation and aquatic organisms from the riparian zone and aquatic environments in and along the Columbia River.	**Assumptions.**
3.1.7.6 Air. The transport of contaminants via the air pathway does not appear to be significant at this time, although during active reactor operations, stack emissions did contribute to surface contamination in the area. Known groundwater contamination is located 40 to 90 ft (12 to 27 m) below ground surface. Known sources of contamination in the vadose zone are located under several feet of clean soil. However, during the field RI, drilling may disturb some contaminated materials, bringing contaminants to the surface. This, in conjunction with strong, persistent winds at the site, will require strict adherence to health and safety procedures and dust control measures during activities such as drilling.	**Pathways that are not significant.**

Submodule 1.3 Initial Evaluation

Scoping	
1.1	Project Management Approach
1.2	Site Understanding
1.3	**Initial Evaluation**
1.4	Data Collection Plan
1.5	Work Plan Preparation

1.3 Initial Evaluation
• Preliminary Risk Assessment
• Preliminary ARARs Assessment
• Preliminary Remedial Action Objectives
• Preliminary Technologies
• Treatability Studies
• Community Relations Issues

Submodule 1.3 Initial Evaluation

Background

Preliminary evaluation of the following is performed to the extent practicable and on the basis of current site understanding:

- Risk Assessment (human health and ecological)
- ARARs Assessment
- RAOs
- Alternatives Development
- Evaluation of Early Actions and Treatability Studies
- Identification of Community Relations Issues

These steps together comprise an initial site evaluation. A large amount of site knowledge is gained through this process of preliminary evaluations (e.g., site risks and possible remediation measures). Most importantly, data gaps become immediately obvious. In addition, the strategy developed in Submodule 1.1 for conducting the risk assessment, including the radiological risk assessment, is confirmed and refined; a list of probable ARARs and preliminary RAOs is developed for the first time and become additional topics for consensus building; needed treatability studies and potential early actions are identified; a preliminary list of issues that requires public input is developed; consensus strategy for the RI/FS project developed in Submodule 1.1 and the site understanding developed in Submodule 1.2 are confirmed and refined; and data needs are identified.

Organization

Submodule 1.3 discusses the following:

- Preliminary Risk Assessment
- Preliminary ARARs Assessment
- Preliminary Remedial Action Objectives
- Preliminary Technologies
- Treatability Studies
- Community Relations Issues

In addition, more detailed information is provided in the following notes:

- Note A–Key Differences Between Chemical and Radiological Risk Assessments
- Note B–Example ARARs
- Note C–Preliminary Remedial Action Objectives

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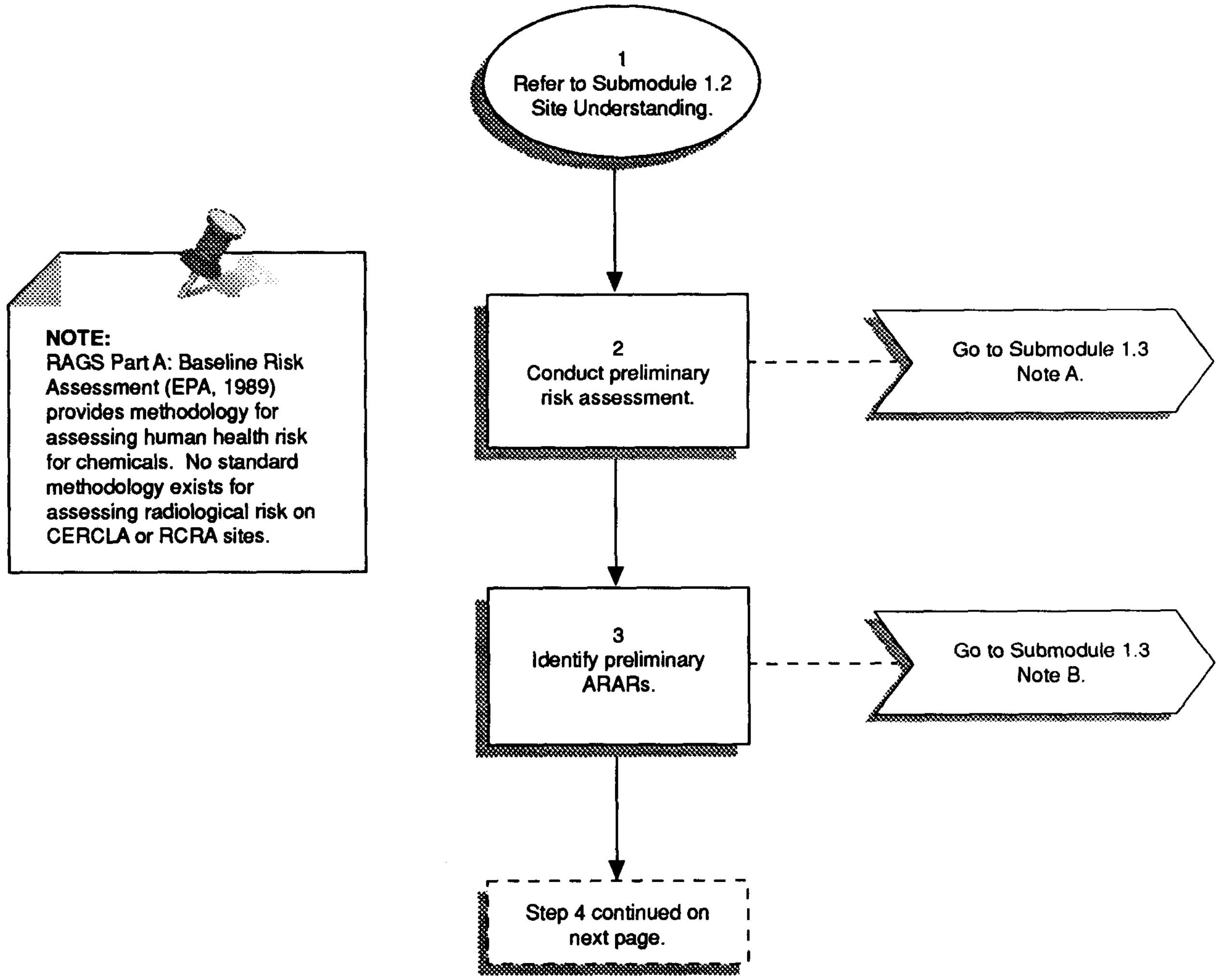
Submodule 1.3 Initial Evaluation



Step 1. Refer to Submodule 1.2, Site Understanding.

Step 2. **Conduct preliminary risk assessment.** A preliminary human health and ecological risk assessment is performed to help identify pathways and scenarios of concern, potential need for accelerated actions, and additional data required for the baseline risk assessment. Identification of the media and contaminants that contribute the most to risk (on the basis of the preliminary risk assessment) helps in focusing data needs. For ecological risk assessments, initial problem scoping should be started (see Submodule 2.4, Note B) and the results included as part of the preliminary risk assessment.

Preliminary risk calculations should be performed for all pathways and scenarios identified in the conceptual site model (Submodule 1.2.). Data gaps result if the existing data cannot support a preliminary risk assessment (the usual case). These data gaps usually become identified data needs to be filled during the RI.

Preliminary risk assessments are typically based on incomplete, but available data. Preliminary risk assessments generally compensate for insufficient data by relying on conservative assumptions. Reducing reliance on conservative assumptions by filling data needs during the RI improves the baseline risk assessment by supporting more realistic estimates of risk (see Module 2, Site Characterization).

An example of a common data gap is the unavailability of background concentrations of chemicals and radionuclides. Preliminary risk assessments often assume background concentrations of zero. RI/FS risk assessments should ensure that calculated risks result from site contamination and not from background levels. Adequate background information is required to conduct the baseline risk assessment (see Module 2). This is especially important for sites with metal and radioactive contamination because these contaminants often have background concentrations above zero.

Differences exist between estimating risk for chemicals and radionuclides. See Submodule 1.3, Note A, for an overview of the major distinctions.

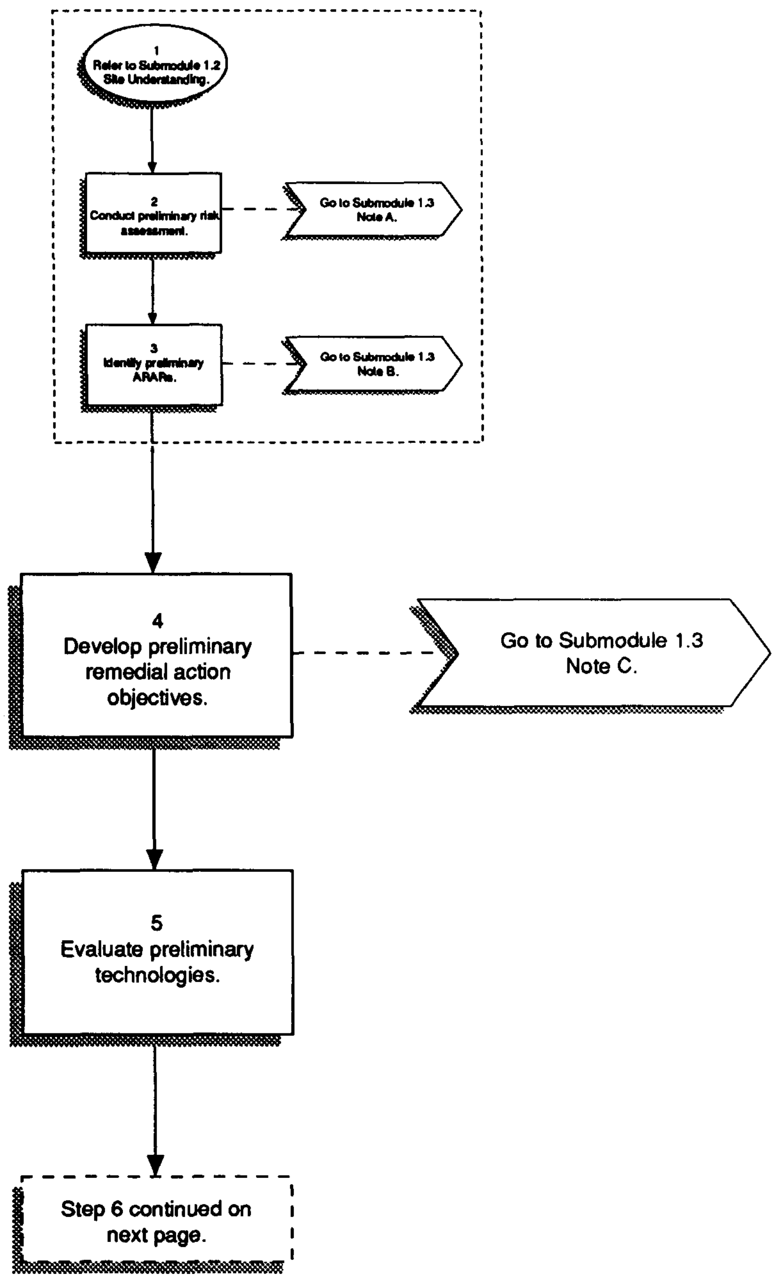
Step 3. **Identify preliminary ARARs.** Identification of potential ARARs, based on existing site understanding, is necessary at this early scoping stage to help identify potential waste management requirements and related data needs. Three types of ARARs are recognized: chemical-specific, location-specific, and action-specific. Definitions are provided in EPA's ARARs Manual, Volume 1 (EPA, 1988).

Chemical-specific ARARs may dictate remediation-level requirements and assist in early establishment of potential remediation goals and data needs. Preliminary identification of chemical-specific ARARs should be based on current site understanding. A listing of example chemical-specific ARARs is given in Submodule 1.3, Note B.

Location-specific ARARs are requirements that limit or restrict activities in certain areas. An example is restriction on actions in wilderness areas, wetlands, and floodplains. Identification of location-specific ARARs should begin during scoping on the basis of current site understanding. Early identification of location-specific requirements can help in identifying and focusing allowable approaches to remediation. An example list of location-specific ARARs is given in Submodule 1.3, Note B.

Submodule 1.3 Initial Evaluation (continued)

Submodule 1.3 Initial Evaluation (cont.)



NOTE:
Even at this early stage, the scope of the study should be limited by focusing on plausible remedial appproaches.

NOTE:
RAGS Part B: Development of Risk-Based Preliminary Remedial Goals (EPA, 1991) should be consulted for more detail on integrating preliminary risk assessments, ARARs, and RAOs.

Action-specific ARARs restrict or regulate treatment and disposal activities. Although identification can begin with current site understanding, screening of technologies during scoping should be completed before action-specific ARARs can be identified. Therefore, action-specific ARARs typically are not addressed during scoping.

ARARs identification can be used to confirm specific data gaps that must be filled to facilitate final ARARs evaluation. State regulations and requirements may also result in ARARs. Specific state statutes should be reviewed that may be applicable and/or appropriate at a specific facility.

CERCLA Compliance With Other Laws Manual (Parts 1 and 2) (EPA, 1988; 1989) and *Risk Assessment Guidance for Superfund (RAGS) B: Development of Risk-Based Preliminary Remediation Goals* (EPA, 1991) are helpful in developing preliminary ARARs.

Step 4. **Develop preliminary remedial action objectives (RAOs).** Following development of the conceptual site model (Submodule 1.2), the potentially contaminated media have been identified. RAOs are developed to help identify potentially feasible alternatives. Preliminary RAOs should be developed for each contaminated medium that could affect human health and ecological receptors. Each preliminary RAO should specify the following:

- Contaminant(s) of concern
- Exposure route(s) and receptor(s)
- Acceptable risk range or contaminant level or range of levels for each exposure route following remediation [i.e., a preliminary remediation goal (PRG)]

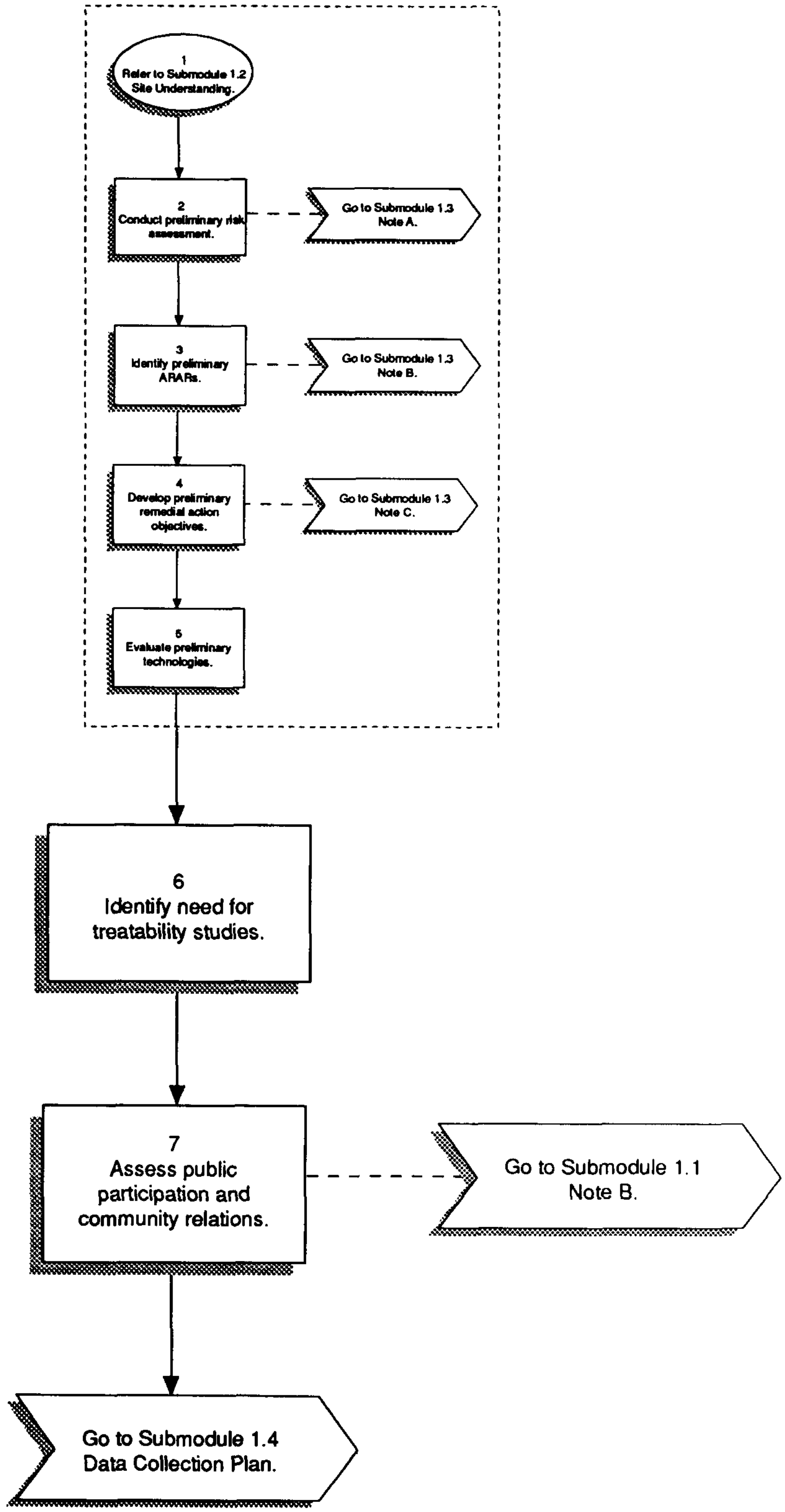
The conceptual site model provides all of this information except remediation goals. Development of preliminary remediation goals using ARARs or preliminary risk assessment results is described in OSWER Directive 9285.7-01B; *Risk Assessment Guidance for Superfund (RAGS) B: Development of Risk-Based Preliminary Remediation Goals* (EPA, 1991).

Preliminary RAOs should be as specific as possible while recognizing site uncertainties. Vague preliminary RAOs can lead to site characterization programs and feasibility studies that are unfocused. See Submodule 1.3, Note C, for further detail on the process of developing preliminary RAOs and examples of acceptable and unacceptable RAOs.

Step 5. **Evaluate preliminary technologies.** Potential remedial technologies are identified at this point in the scoping effort to further identify data needs. Alternatives will have to be evaluated in the feasibility study against seven technical criteria (see Module 5, Detailed Analysis of Alternatives). Data collection efforts should be focused, to the extent possible, on gathering the data that will be required in the detailed evaluation.

An important opportunity for streamlining the RI/FS at this point is to reduce the preliminary list of technologies to focus only on plausible remedial alternatives. A full range of remedial alternatives will not require evaluation in the feasibility study if that range includes options that are clearly unlikely to be implemented, either for regulatory

Submodule 1.3 Initial Evaluation (cont.)



reasons or for reasons of effectiveness, implementability, and cost. In addition, the reliability and acceptability of potential technologies should be assessed for potential viability. The scope of the study should be limited by focusing on truly plausible remedial approaches even at this early stage.

EPA has worked extensively to develop presumptive remedies for sites that have contamination problems that are well understood (e.g., municipal landfills, PCB-contaminated soils); these remedies may assist in identifying viable technology options at this stage of the process. In addition, EPA policy encourages the use of past records of decision (RODs) as an excellent basis for technology evaluations. Given the current limited number of options for managing some DOE wastes, past decisions and technology availability constraints can support significant narrowing of options even this early in the process.

Two types of data gaps may be associated with technologies. First, data may be needed to evaluate the feasibility of the technology (e.g., whether low-temperature thermal desorption can achieve the preliminary remediation goal). Second, data may be needed to support alternative evaluation (e.g., Btu values of the wastes will be required to evaluate the costs of incineration as an alternative). The DOE project manager or designee will need to determine whether these data gaps represent data needs.

Step 6. **Identify need for treatability studies.** Early identification and initiation of necessary treatability studies is valuable to support selection of the remedy. Treatability studies may also support EPA's bias for action, reduce risk to human health or environmental receptors, or support DOE's broader technology development programs.

Treatability studies at some scale (e.g., pump tests, treatment technology trials) will be useful for most alternatives. Treatability studies also are useful for determining the appropriateness of innovative technologies and the effectiveness of conventional technologies under site-specific conditions. For example, performing sensitivity analysis to identify key controlling parameters (see Submodule 5.1, Note A) for technology effectiveness and determining their variability over time is a common use of treatability studies. This determination also will help in estimating probable conditions and assessing reasonable deviations.

If a treatment technology or emerging and innovative technology is identified as a preliminary remedial action alternative, a treatability study may be required to develop the data necessary for evaluation of alternatives that incorporate the technology. Emerging or innovative technologies often require small-scale testing or specific performance and design data to evaluate implementability and effectiveness. Treatability studies can be used to provide this information. Identifying the need for treatability studies during scoping, either as an emerging or an innovative technology, allows early planning for identifying data needs. See Module 3 for additional detail on conducting treatability studies.

Step 7. **Assess public participation and community relations.** CERCLA and the NCP require DOE to conduct community relations activities during the RI/FS. DOE has established more extensive public participation and stakeholder involvement requirements. The fundamental aspect of community relations during an RI/FS is early and consistent involvement of stakeholders in all steps of planning and implementation. A public

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participation plan about environmental restoration of a waste site will be developed as part of scoping activities and included in the work plan. Submodule 1.1, Note B, provides additional information on public participation strategy.

Facility-wide community relations plans should exist for CERCLA and RCRA activities at each DOE facility. These plans specify, in general terms, the community relations activities that will be appropriate for an RI/FS project. However, each specific project may have additional needs and/or opportunities for public involvement at each step of the decisionmaking process. For example, stakeholder opinions may be necessary for identifying potential data needs or topics that should be addressed in the work plan. Such issues can include potential receptors (past, present, or future); effects on recreation; adjacent or competing land use; future land use; and cultural issues.

Guidance on Public Participation for U.S. Department of Energy Environmental Restoration Activities (DOE, 1991) and *Community Relations in CERCLA: A Handbook* (EPA, 1988) should be consulted for detailed information on community relations issues.

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Note A. **Key Differences Between Chemical and Radiological Risk Assessments**.

Primary Risk Indicator. For cancer endpoints, CERCLA chemical risk assessments use cancer incidence as the primary indicator of risk. Radiological risk assessments traditionally use cancer mortality, although cancer mortality can be translated to cancer incidence. Because DOE has not developed a "standard" for radiological risk methodology for its facilities, the radiological risk assessment primary indicator is not consistently cancer mortality. Early determination and specification of the primary indicators is important and should be clearly established with the regulators.

Radiological Risk Methodology. Radiological risk methodology is based on radiation dose or radioactivity intake. The radiological assessment should include information about radiation doses and can include cancer mortality as an option. The methodology to be used should be established with the regulators.

Compatibility. Chemical and radiological risk assessments should be kept as compatible as possible to facilitate communication and reduce the opportunity for technical confusion. For example, both chemical and radiological risk assessments should use cancer incidence risk. Because differences in methodology between chemical and radiological risk assessment are significant, the risks often are shown separately and not added.

Chemical and radiological risk assessments can be added if they are developed using similar, standardized methodologies (e.g., EPA slope factors) or if they have been translated into similar units (e.g., cancer incidence). Because a standard approach does not exist for DOE facilities, note that consensus about methodology development is critical within the extended project team. Equally critical is explanation of the methodology and use when communicating results to the stakeholders.

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<u>Note B</u>. **<u>Example ARARs</u>**. This list is intended as illustrative and is not a complete list of ARARs.

Chemical-Specific ARARs

- Safe Drinking Water Act and regulations (Federal)
- State Drinking Water Act and regulations
- RCRA Groundwater Protection Standards
- State RCRA-equivalent regulations
- Nuclear Regulatory Commission Standards for Protection Against Radiation
- State radiation protection standards
- State radiation emission standards
- Clean Water Act and regulations (Federal)
- State Water Quality Standards
- Toxic Substances Control Act regulations
- National Emission Standards for Radionuclide Emissions from DOE facilities
- EPA Radiation Protection Standards for Managing and Disposing of spent nuclear fuel; high-level and transuranic radioactive wastes
- Clean Air Act
- National Primary and Secondary Ambient Air Quality Standards

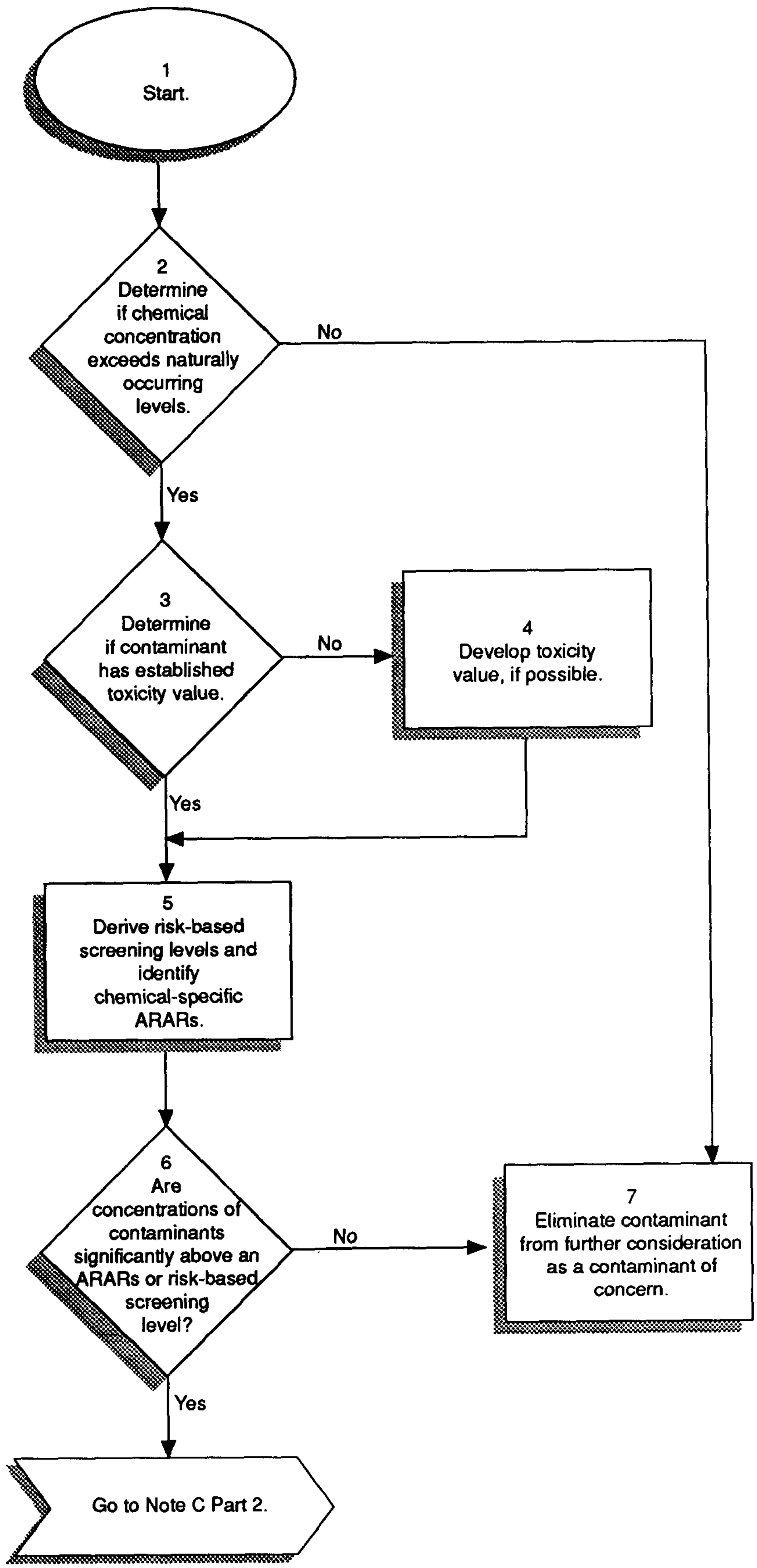
Location-Specific ARARs

- RCRA treatment, storage, and disposal (TSD) siting requirements
- Executive Order 11990 on wetlands
- Executive Orders 11988 and 11990; actions within a floodplain
- Clean Water Act Section 404 wetlands protection
- Protection of areas that are part of the National Wildlife Refuge system
- Fish and Wildlife Coordination Act
- Wild and Scenic Rivers Act
- National Historic Preservation Act

Action-Specific ARARs

Any of the chemical-specific ARARs can control the design and implementation of remedial actions. In addition, note the following.

- RCRA TSD facility requirements
- RCRA land disposal restrictions (LDRs)
- U.S. Army Corps of Engineers dredging and filling permits
- National Pollutant Discharge Elimination System
- Clean Air Act: National Emission Standards for Hazardous Air Pollutants
- Endangered Species Act (ESA)


1
Start.
2
Determine if chemical concentration exceeds naturally occurring levels.
No
Yes
3
Determine if contaminant has established toxicity value.
No
4
Develop toxicity value, if possible.
Yes
5
Derive risk-based screening levels and identify chemical-specific ARARs.
6
Are concentrations of contaminants significantly above an ARARs or risk-based screening level?
No
7
Eliminate contaminant from further consideration as a contaminant of concern.
Yes
Go to Note C Part 2.

<u>Note C</u>. **<u>Preliminary Remedial Action Objectives</u>**.

Development of preliminary /RAOs consists of four primary parts: (1) identifying contaminants of concern; (2) identifying potential pathways and receptors; (3) developing PRGs for each contaminant of concern/medium/land-use scenario; and (4) combining elements into an RAO.

The RAO process described in this note is also used later in the RI/FS process when confirming and finalizing RAOs prior to alternatives development (see Module 4). During scoping, available information is used to develop preliminary RAOs. Additional information gained during the RI is used to confirm and revise RAOs during the FS. Preliminary RAOs need to account for human health and ecological contaminants of concern, pathways, and receptors.

Part 1. Identify Contaminants of Concern

Step 1. Start.

Step 2. Identifying contaminants of concern is dependent on the background levels of chemicals if background levels are available: chemicals above background levels may be contaminants. Chemicals beneath background levels should not receive further consideration as contaminants of concern. Chapter 5 of RAGS, Part A (EPA, 1989) provides additional information on contaminants of concern.

Step 3. Toxicity values of contaminants are taken from either the EPA Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Table (HEAST) databases. If the contaminant toxicity value is available from either of these databases, it is referred to as an established toxicity value.

Step 4. For some chemicals, EPA-derived toxicity values are not available. RAGS Part A, Volume 1, Section 7.5 (EPA, 1989), provides recommended measures for such situations.

Step 5. The procedure for deriving risk-based screening concentrations is presented in RAGS, Part B (EPA, 1991). Some EPA Regions have developed separate procedures that should be considered. Submodules 1.3 and 5.2 present more information about identifying chemical-specific ARARs.

Step 6. Contaminant concentrations identified at the waste site should be compared with identified chemical-specific ARARs or with the risk-based screening concentration. The contaminant should not be considered further if the contaminant levels do not significantly exceed either ARARs or risk-based screening concentrations, or otherwise contribute significantly to cumulative risk.

Contaminants of concern are further considered in three stages: (1) PRGs developed in Part 4 of RAO development; (2) as one focus of the RI; and (3) as the contaminants evaluated in the baseline risk assessment. The list of contaminants of concern developed during scoping is preliminary and subject to change (additions or deletions) throughout the remainder of the RI/FS process.

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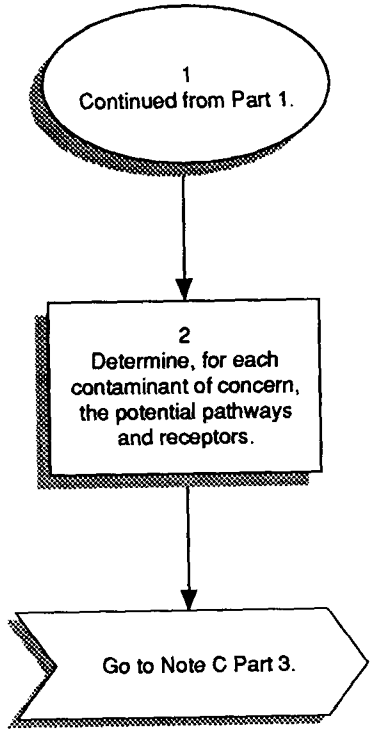
Step 7. If contaminants are not significantly above background, and not above ARARs or risk-based screening levels, they are not probable contaminants of concern.

Continue to Part 2, Identify Potential Pathways and Receptors.

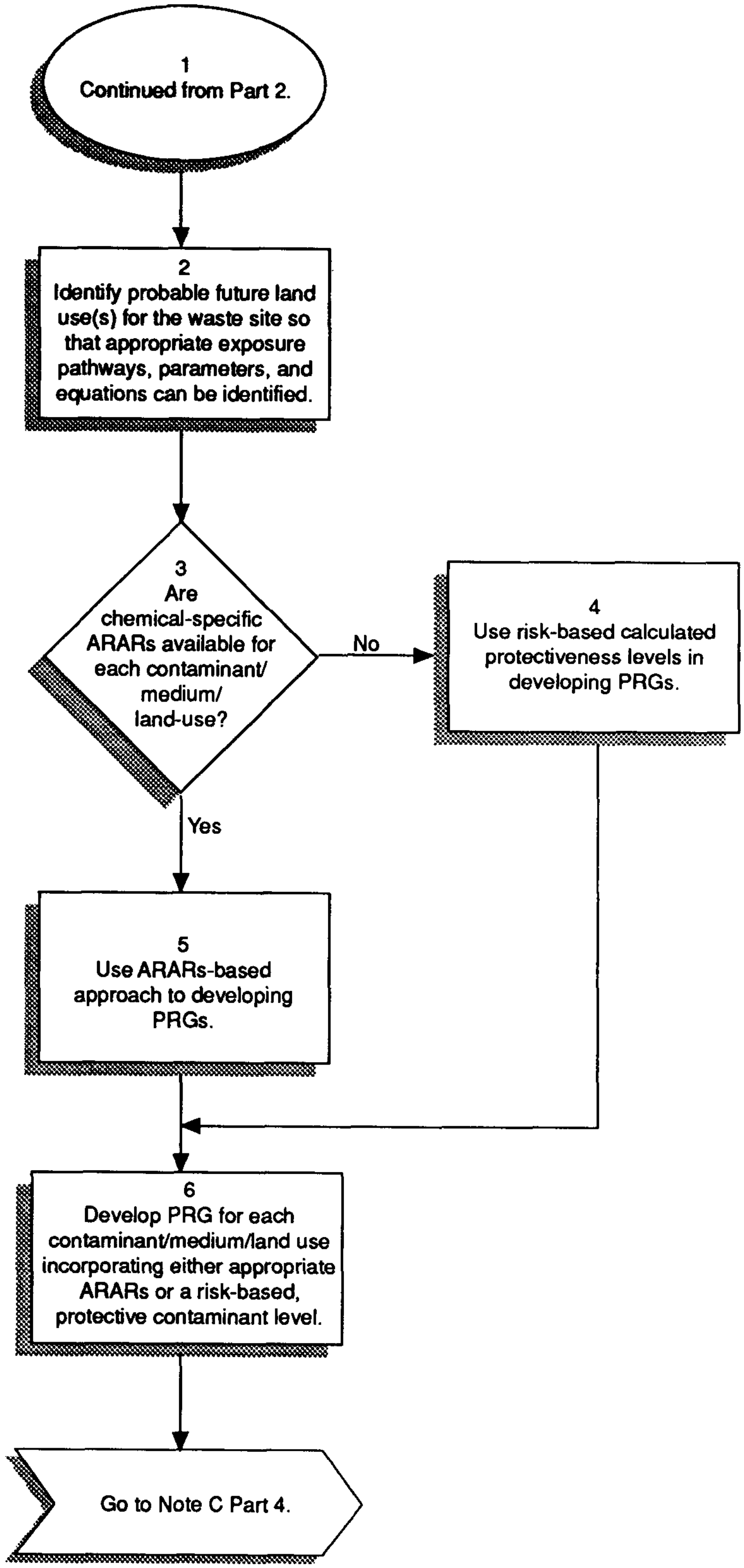

1
Continued from Part 1.
2
Determine, for each contaminant of concern, the potential pathways and receptors.
Go to Note C Part 3.

Part 2. Identify Potential Pathways and Receptors

Step 1. Continued from Part 1.

Step 2. For each contaminant of concern, potential pathways and receptors (i.e., pathways are inclusive of contaminants, medium, migration mechanism, receptor, and exposure) should be identified using the conceptual site model. This information will be used to develop preliminary remediation goals (PRGs) in Part 3 of this note.

Continue to Part 3, Develop PRGs for Each Contaminant/Medium/Land-Use Scenario.


1
Continued from Part 2.
2
Identify probable future land use(s) for the waste site so that appropriate exposure pathways, parameters, and equations can be identified.
3
Are chemical-specific ARARs available for each contaminant/ medium/ land-use?
No
4
Use risk-based calculated protectiveness levels in developing PRGs.
Yes
5
Use ARARs-based approach to developing PRGs.
6
Develop PRG for each contaminant/medium/land use incorporating either appropriate ARARs or a risk-based, protective contaminant level.
Go to Note C Part 4.

Part 3. Develop PRGs for Each Contaminant/Medium/Land-Use Scenario

Step 1. Continued from Part 2.

Step 2. The probable future land use(s) for the site must be determined to enable identification of appropriate exposure pathways, parameters, and equations. These will be used to determine risk-based, calculated values of preliminary remediation goals. Future land uses are uncertain for most DOE facilities. Submodule 2.4, Note C, provides more insight into future land uses at DOE facilities.

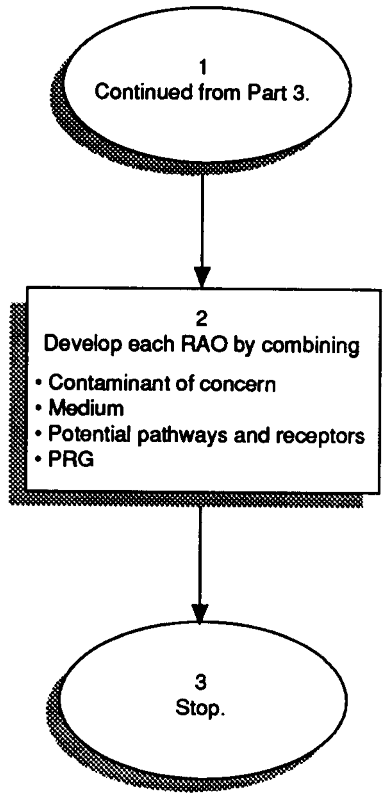
Step 3. Chemical-specific ARARs are identified for each combination of contaminant/medium/land-use. This is the ARARs-based approach to developing PRGs. A risk-based, calculated PRG is developed if an ARAR is not available or if it is determined that the ARAR is not protective.

Step 4. Exposure pathways and routes, exposure parameters, and risk calculation equations have been identified for each contaminant/medium/land-use combination from Parts 2 and 3. Using the risk-based calculated contaminant levels and the most appropriate and readily available toxicity values (either established or calculated), identify the contaminant level that is considered protective.

Step 5. If a chemical-specific ARAR is available, a PRG is developed on that basis. Submodules 1.3 and 5.2 provide more information on ARARs. Action-specific ARARs are not considered during development of preliminary RAOs.

Step 6. PRGs are developed for each contaminant/medium/land-use combination by using an appropriate chemical-specific ARAR or a risk-based protective contaminant level.

Continue to Part 4, Develop Preliminary Remedial Action Objectives.


1
Continued from Part 3.
2
Develop each RAO by combining
• Contaminant of concern
• Medium
• Potential pathways and receptors
• PRG
3
Stop.

Part 4. Develop Preliminary Remedial Action Objectives

Step 1. Continued from Part 3.

Step 2. Develop individual preliminary RAOs by combining the contaminants of concern (Part 1), medium of interest (Part 2 and 3), potential pathways and receptors (Part 3), and PRGs (Part 3).

RAOs should be as specific as possible while recognizing site uncertainties. Vague RAOs can lead to unfocused site characterization programs and FSs.

Examples of specific RAOs are as follows:

- Prevent direct-contact human exposure to strontium-contaminated surface soils above levels determined to exceed the range of 10^{-4} to 10^{-6} excess lifetime cancer risk.
- Meet state ambient water quality standards for protection of resident trout from heavy metals in the Green River at its confluence with Yellow Creek.
- Prevent breach of pond berms and subsequent release of contaminated pond sediments caused by a design flood or a design earthquake. The design flood is one-half the probable maximum flood (PMF) and the design earthquake is the maximum credible earthquake (MCE).
- Meet ambient water quality criteria at a compliance immediately above the defined starting point of the Clark Fork River.
- Prevent ingestion of water within the operable unit above the state maximum contaminant levels or above established reference doses for copper, iron, lead, zinc, and cadmium.
- For groundwater, the RAO is to reduce the levels of arsenic and cadmium to achieve compliance with the state maximum contaminant levels throughout the contaminant plume.
- Prevent ingestion and direct contact with soil having polycyclic aromatic hydrocarbon (PAH) contamination above a risk range of 10^{-4} to 10^{-6}.

Example of a non-specific RAO follows:

- Protect public health and the environment from exposure to site contaminants.

Step 3. Stop.

Submodule 1.4 Data Collection Plan

Scoping	
1.1	Project Management Approach
1.2	Site Understanding
1.3	Initial Evaluation
1.4	Data Collection Plan
1.5	Work Plan Preparation

1.4 Data Collection Plan
• Establishing Data Needs
• Completing DQOs
• Defining RI Tasks

Submodule 1.4 Data Collection Plan

Background

The work plan must specify in appropriate detail why data are being collected, what data will be collected during the remedial investigation, and how the data will be collected. This submodule explains the use of the DQOs process and the principles of the SAFER approach (see Module 7) to establishing an effective but minimum data collection effort.

Organization

Submodule 1.4 discusses the following:

- Establishing Data Needs
- Completing DQOs
- Defining RI Tasks

In addition, more detailed information is provided in the following notes:

- Note A–EPA DQO Process
- Note B–Decision Rules
- Note C–Example RI/FS Task

Sources

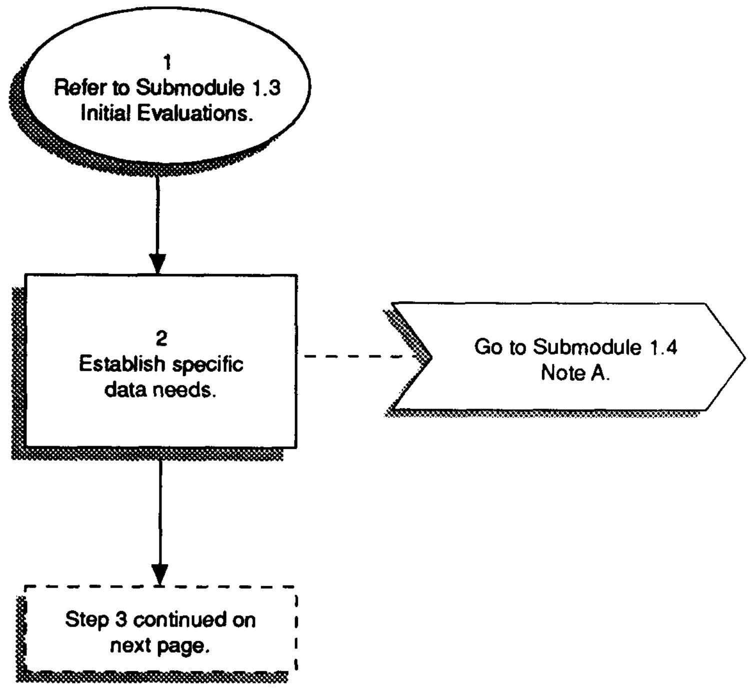
1. U.S. DOE, January 1991, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-08, Draft A.

2. U.S. EPA, March 1987, *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003, OSWER Directive 9335.0-7B.

3. U.S. EPA, October 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Interim Final, EPA/540/G-89/004, OSWER Directive 9355.3-01.

Submodule 1.4 Data Collection Plan

NOTE:
Basic principles of the DQO:
1. Data are collected for specific data needs.
2. Data needs are identified by data users, not data collectors.
3. No data should be collected unless a specific purpose has been identified, including the required decision, resulting action, and allowable uncertainty.



Step 1. Refer to Submodule 1.3, Initial Evaluation.

Step 2. **Establish specific data needs.** The goal of this step is to develop a list of very specific and carefully justified data needs that will define the scope of the data collection efforts during the RI. All decisions to be made during the RI/FS process and, hence, all legitimate data needs for the RI/FS process, occur in connection with one or more of the following major activities:

- Completing a risk assessment (human health and ecological)
- Conducting an ARARs analysis
- Developing, evaluating, and (later) designing remedial alternatives

Data that are not needed for one of these three purposes are unnecessary to the RI/FS and probably should not be collected. Very few exceptions occur; these exceptions generally relate to stakeholder interests that are not directly relevant to these major activities, to the RI/FS, or to health and safety concerns for site workers.

Data collection is very expensive and involves some risk (e.g., chemical exposure, site hazards) to the field personnel. *The DQOs process is the primary tool for ensuring that no unnecessary data are collected*. See Submodule 1.4, Note A, for additional detail on DQOs.

The potential data needs identified in Submodule 1.3 should be reviewed. These will serve as the basis for defining specific data needs. Confirm that each potential data need can be related to a specific data gap and is required to meet one or more of the three objectives listed above. If a specific need cannot be identified on the basis of these objectives, determine if there is a related issue (e.g., community relations) that justifies the data need. (Information about ecological data needs are discussed in Submodule 2.4, Note B.)

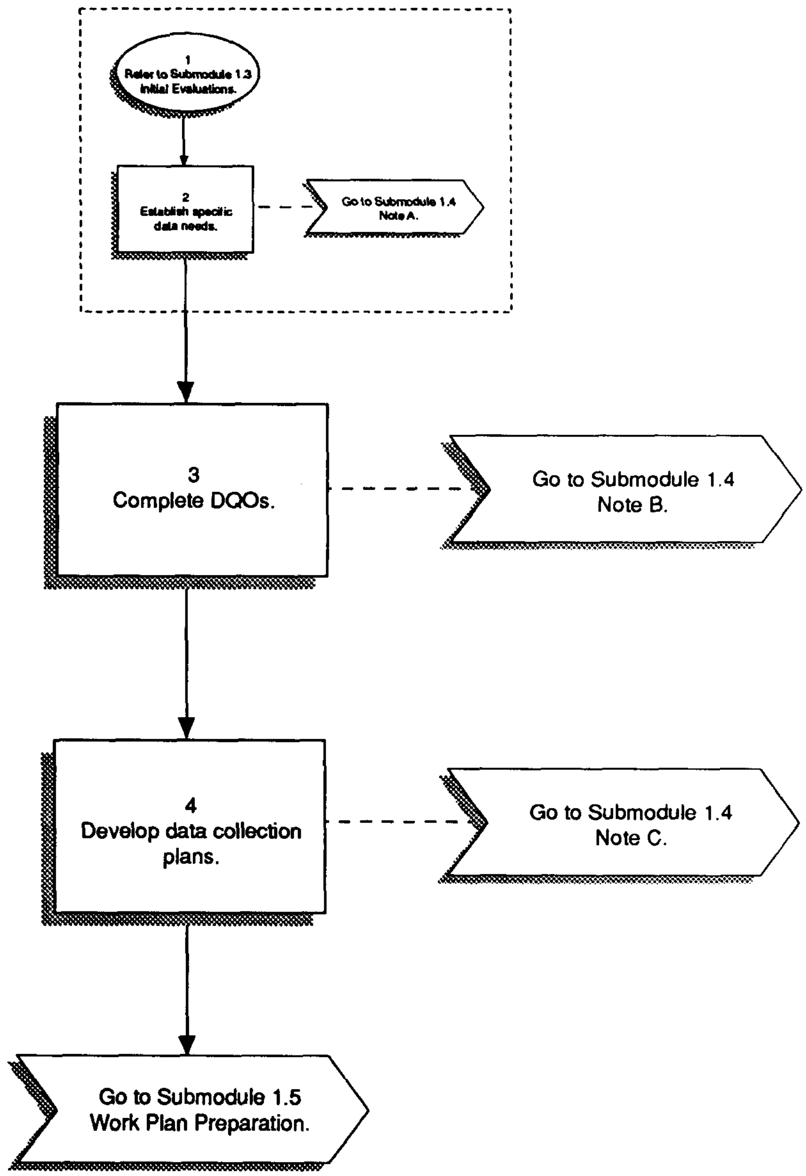
Some data gaps do not become data needs. The necessity to fill data gaps exists only if the uncertainties associated with the data gaps are not acceptable or cannot be managed. These data gaps are identified as data needs.

For example, assume that soil contamination at a site is known well enough to complete an ARARs analysis, baseline risk assessment, and order-of-magnitude cost estimates for excavation and disposal, but not well enough to lay out a detailed excavation plan. Detailed sampling could fill such a data gap. Data collection during excavation activities can be done using field screening techniques or field support laboratories to determine the bounds of the excavation. This data gap is acceptable because it can be easily managed during the response action itself; it does not constitute a data need for the RI.

Final data needs are established by consensus with the extended project team, and through stakeholder input. The required data characteristics should be explicitly developed for each specific data need. The data description should include what the data consist of, where they will be collected, when they will be collected (period and frequency), and the decisions in which they will be used. Proper use of the DQO process will facilitate the development of data descriptions.

Submodule 1.4 Data Collection Plan (cont.)

NOTE:
The tasks as written in the work plan and its appendices should be sufficiently clear and specific so that contractors not involved in the work plan development could conduct work plan activities independently.



Step 3. **Complete DQOs.** Once the data needs are established, the DQO process is completed by determining data quantity and quality. The amount of data that will be required to achieve a particular level of certainty is as important as the analytical quality level. This aspect of the DQO process often is not given sufficient attention during scoping. EPA's DQO Guidance document (EPA, 1987) explains in detail the process for ensuring that an adequate amount of data are collected for the identified purposes.

The analytical level (quality) required for specific data needs is an important part of the DQO concept. EPA has defined five levels of analysis for samples (see Submodule 1.4, Note A) and provided example data uses and analysis for each level. In general, the higher levels of analysis equate to greater costs and time requirements. The level of acceptable uncertainty is related to analytical level because, in general, when the level of acceptable uncertainty is high, fewer data are required. Thus, the time and cost of analysis is reduced. These tradeoffs should be analyzed during the design of a data collection program. The DQO Guidance (EPA, 1987) provides more detail on appropriate analytical levels for varying data uses. Use of the appropriate analytic levels of data (e.g., Level 3 vs Level 4) is an effective streamlining measure. Litigation-quality backup documentation (as provided with Level 4 data) is rarely necessary at DOE OUs because DOE typically faces low-litigation potential. Based on these factors, the DOE project manager or designee should identify and develop appropriate analytic levels to support decisions with the extended project team.

Spatial variability in samples is also an important contributor to uncertainty in data quality. Methods used in the DQO process that are important in reducing spatial sources of variability include use of statistical techniques; careful definition of decision objectives in the form of a stated hypothesis; discussion of acceptable levels of error in the resulting decision; and the use of optimized statistical design to obtain spatially representative data at minimum cost.

The final data needs, as attained by extended project team consensus, are presented in Chapter 4 of the work plan, Work Plan Rationale. This chapter specifies the reasons for each type of data collection.

[Note: EPA is expected in the near-term to release new DQO guidance. Once issued, DOE will provide updates to this submodule, as appropriate.]

Submodule 1.4, Note B, describes one technique that can be used to complete the DQO process.

Step 4. **Develop data collection plans.** Data collection subtasks are defined for each of the data needs. Each data collection subtask includes sampling design; sampling method; and sample numbers, types, and locations.

The data collection plans and sampling and analytical protocols are presented in Chapter 5 of the RI/FS work plan and its appendices. The tasks, as written in the work plan and its appendices, should be sufficiently clear and specific. This requisite would allow a contractor that was not involved in the work plan development to complete the work on an independent basis. Submodule 1.4, Note C, provides an example RI/FS task for site characterization.

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Note A. **EPA DQO Process.** The basic aspects of the DQOs process are repeated here as follows:

- Data needs and DQOs should be specified by those who will use the data, not by those who will collect it. However, data collectors also need to know why particular data are being collected.
- Data should be collected only to meet identified needs–not for general site characterization. The decision(s) to be supported by the data should be specified before data collection.
- The quantity and quality of each type of data to be collected, including the required level of supporting quality assurance/quality control (QA/QC) documentation for any analysis, should be specified before collection so that the data will be appropriate for the intended use.

The DQO process is a two-step process for identifying data needs. First, the types of decisions that need to be made during the RI/FS are exhaustively identified. Second, the types of data that will be required are identified and compared with the available data to identify gaps. A third step, not covered in the EPA DQO process, involves identifying the data gaps that will have to be addressed by collecting additional data and the data gaps that represent uncertainties about the site that can be managed while conducting remedial actions (RAs). Only the data gaps that cannot be managed as acceptable uncertainties become data needs and have to be filled through data collection efforts during the RI.

[Note: EPA is expected in the near-term to release new DQO guidance. Once issued, DOE will provide updates to this note, as appropriate.]

Analytical Levels for the DQO Process.

Level I–field screening or analysis using portable instruments. Results often are not compound specific and not quantitative, but results are available in real time. It is the least costly of the analytical options.

Level II–field analysis using more sophisticated portable analytical instruments; in some instances, the instruments may be set up in a mobile laboratory on the site. A wide range of data quality can be generated depending on the use of suitable calibration standards, reference materials, sample preparation equipment, and operator training. Results are available in real time or several hours.

Level III–all analyses performed in an offsite analytical laboratory. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but generally do not use the validation or documentation procedures required of CLP Level IV analysis. The laboratory may or may not be a CLP laboratory.

Level IV–CLP Routine Analytical Services (RAS). All analyses are performed in an offsite CLP analytical laboratory by following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.

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Level V−analysis by nonstandard methods. All analyses are performed in an offsite analytical laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP Special Analytical Services (SAS) are Level V.

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<u>Note B</u>. **<u>Decision Rules</u>.** Decision rules are statements that (1) summarize the output of the DQO process and (2) identify the decision being made, the type and quality of data needed to support the decision, and the resulting action pending the decision. To develop a decision rule, a format should be used that links the probable condition and the decision by specifying what data will be collected and how data will be used. The quantity and quality of data that are collected are determined by the level of acceptable uncertainty in making the decision.

Example Characterization Decision Rules

- Aquifer−If concentration of TCE exceeds 20 ppm in any monitoring well screened in the shallow portion of the upper aquifer from which a quarterly aggregate sample is collected over 24 hr, then the portion of aquifer represented by the screened interval will be considered above action level and will require further investigation.

- Soil−If XRF screening results indicate the soil in any of the 100-ft segments of the soil in any of the 100-ft segments of the berm likely contains lead at or above 500 ppm, confirmatory samples will be collected from that segment according to the procedure in Section X.Y of this sampling plan and sent to the offsite laboratory for analysis as specified in the QAPP.

Example Remediation Decision Rule

- If the concentration of TCE at the well head in each of the extraction wells becomes asymptotic or decreases below the Maximum Contaminant Level (MCL), the extraction and treatment of water will cease and a risk evaluation will be conducted for the asymptotic wells to determine if it is below 10^{-4}. If greater than 10^{-4}, a permanent alternative supply of drinking water will be provided.

Example Deviation Decision Rule

- If the concentration of radon exceeds 5 pCi/L of air at the working fence line in any monitoring station during remediation, a mechanical ventilator will be used until the concentration decreases below 5 pCi/L.

The extended project team should reach consensus on the decision rules, including the level of acceptable uncertainty, that will be used in the RI and FS.

Determining an acceptable level of uncertainty in data is important in defining technical data sufficiency. The level of acceptable uncertainty will vary with the specific data use. For example, the acceptable uncertainty for data required for ARARs determination may be lower (i.e., less uncertainty) than that required for development of remedial alternatives. The level of acceptable uncertainty also will affect the cost of obtaining data. A larger level of uncertainty can be acceptable if plans to manage the uncertainty can be developed, such as use of contingency plans. The key to this step is to define an acceptable level of manageable uncertainty.

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Level V−analysis by nonstandard methods. All analyses are performed in an offsite analytical laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP Special Analytical Services (SAS) are Level V.

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<u>**Note C**</u>**.**

<u>**Example RI/FS Task**</u>**.** The work plan should describe each RI and FS task separately in the Rationale and Approach section, by providing detailed rationale and objectives for each task. These detailed descriptions serve as background for the task descriptions in the FSP, which are briefer and do not repeat the rationale and objectives.

This example task description is an excerpt from a draft work plan for the Hanford Site. The 100-BC Area at Hanford includes the B Reactor area and the C Reactor area. The surface sources and facilities have been divided into four OUs (100-BC-1, 100-BC-2, 100-BC-3, and 100-BC-4). The groundwater beneath the entire 100-BC Area is OU 100-BC-5. This excerpt is from a draft of the 100-BC-5 RI/FS work plan. Its use is illustrative and should not be interpreted as activities currently under way in the 100-BC Area at Hanford.

Task descriptions should be worked out in detail. Inconsistencies and gaps in logic become apparent when a description is detailed and explicit. Thinking through a task at this level and subjecting it to technical review is critical to refining a work plan that optimizes the value that can be derived from a minimized data collection effort.

Uncertainties in how the task should be carried out should be clearly delineated and left to the field team to resolve in the field. Given the site uncertainties, this task description provides the best possible direction for locating the wells. Note that some data collection tasks that were envisioned, particularly deep wells into the confined aquifer, are not being pursued because they could not be justified on the basis of the conceptual model and the DQOs.

The following example is an unedited version of an RI task description as it appeared in the draft work plan (U.S. DOE, January 1991, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-08, Draft A).

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5.1.6.2.3 Activity 6b-3—Drilling and Sampling. This activity is synchronous with Subtask 2c (Geophysical and Radiation Surveys) and Activity 3b-2 (Drill Site Evaluation). The locations of the 24 proposed well completions are shown in Figure 5-1. Well locations are shown as squares representing multiple completions and circles representing single well completions. The relative size of the squares and circles correlates to the degree of uncertainty as to the specific well placement. Four hydrostratigraphic units will be monitored: the basal Ringold (referred to as D-level wells), the base of the middle Ringold, just above the "blue clay" (referred to as C-level wells), the middle Ringold (referred to as B-level), and the top of the shallow aquifer (referred to as A-level). The monitoring wells can be described in five groups as follows:

- There will be three well clusters to monitor the four hydrostratigraphic units—the well clusters are located in the NW, NE, and SE corners of the 100-B/C Area (see Figure 5-1). The existing 199-B3-1 well will be made a part of the cluster at the NE corner of the area. The existing 199-B3-1 well is completed for monitoring at the water table.

- There will be one well cluster to monitor three units—the lower Ringold Formation above the clay layer, the middle Ringold, and at the water table. This well cluster is located in the SW corner of the area.

- There will be one well pair to monitor the middle Ringold Formation and at the water table. This well pair is located northeast of the B Reactor, near the center of the area.

- There will be eight wells to monitor at the water table. These wells are located within the area to provide a better distribution of data points for evaluation of shallow groundwater flow, and to provide source-specific chemistry data for evaluation of interim remedial measures.

The zones targeted for well completion are illustrated in Figure 5-3. The basis for monitoring in each of these zones is presented in the following sections. Figure 5-4 summarizes the data needs rationale for each well completion with respect to the groundwater as well as the geology investigation.

Deep wells will not be drilled into the basalts during the Phase I RI. A better understanding of the vertical movement and nature and extent of contamination in the Ringold Formation is required to justify and optimize such deep drilling. Existing data will be compiled and examined during the RI for evidence of contamination in the basalt as well as to better understand the extent and magnitude of the groundwater mound and potential effects on groundwater gradients. Also, wells will not be drilled on the north side of the Columbia River. Flow directions, vertical gradients, and groundwater

The work plan must justify each data collection effort.

Evaluation of the conceptual model determines which questions do not need to be pursued and indicates data gaps that need to be filled.

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quality data in C- and D-level must be evaluated and justification must be demonstrated before cross-river and other offsite drilling is conducted. Three wells will be completed in the basal Ringold Formation (D-level wells) (see Figure 5-1). These wells will provide hydraulic head data, estimates of hydraulic conductivity, and groundwater samples for chemical and radiological analyses. Evaluation of these data will provide the following:	
• Estimate of the horizontal gradient direction and magnitude in the basal Ringold unit, assuming a planar groundwater potentiometric surface • Estimates of the vertical gradient direction and magnitude between other monitored hydrostratigraphic units in the overlying sediments and underlying Ellensburg Formation (monitored at 199-B3-2Q) • Better understanding of the nature and extent of contamination in the basal Ringold unit and possibly the relationship between contaminants in the shallow aquifer and basal Ringold unit. D-level wells will be completed at cluster locations 199-B10-1, 199-B10-3 and 199-B10-4. The cluster wells were located along the boundaries of the site in the NW, NE, and SW corners (see Figure 5-1). This lateral distribution will provide the sitewide data for this initial evaluation of the basal Ringold Formation in Phase I.	**The specific use(s) must be given for each data point or data type.**
Four wells will be completed in the middle Ringold Formation above the blue clay (C-level wells). These wells will provide hydraulic head measurements, estimates of hydraulic conductivity, and groundwater data at the base of the unconfined aquifer. Monitoring in this zone is important to verify the present conceptual model that indicates the blue clay is an effective barrier to vertical groundwater flow. Groundwater chemistry and hydraulic head differences between the basal and lower Ringold Formation will be evaluated and will be compared to test this model. The C-level wells will be completed at cluster locations 199-B10-1, 199-B10-2, 199-B10-3 and 199-B10-4 (see Figure 5-1).	**RI data will be used to verify and improve the conceptual model to provide information required for assessing pathways.**
A monitoring well will be installed at the base of the upper sand and gravel unit in the middle Ringold (B-level wells) at the five cluster locations (see Figure 5-1). Data from these wells will be used to evaluate the chemical stratification in the unconfined aquifer. The groundwater from the existing wells completed near the top of the aquifer (A-level) is contaminated. These deeper B-level wells will provide data to assess the vertical extent of contaminants in this upper hydrostratigraphic unit. Vertical groundwater movement within the shallow aquifer may also be evaluated from hydraulic head data collected at these well cluster locations.	**How the data will be evaluated.**

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Twelve wells will be installed at the top of the shallow aquifer (A-level) (see Figure 5-1). This zone will be studied in the greatest detail in Phase I because the shallow groundwater system is known to be contaminated (see Section 3.1.3) and the nature and extent of contaminants in this zone must be better defined before conclusions can be made with respect to risk assessment, ARARs and screening of remedial alternatives (including no-action). Additional source specific wells (contingency wells) may be installed to assess the need for interim remedial measures.

The most intensive investigation is directed to the locations that the conceptual model indicates are the most contaminated or the most significant sources.

Four A-level wells will be completed at the cluster locations. Eight additional wells will be distributed across the site to supplement existing water level and groundwater chemistry information. Source-specific wells will be installed in coordination with the source operable unit investigations. Shallow wells installed for source-specific monitoring (see Figure 5-4) will be installed on the north side of potential sources, if possible. The borings are located on the north side of potential sources because this is assumed to be the downgradient side; however, it is not possible to accurately predict downgradient with existing data given the influence of river stage. Additional wells may be required in Phase II to supplement Phase I wells.

The drilling program is designed to meet the goals and objectives of Task 6, minimize exposure to field personnel, and reduce the possibility of cross contamination between water-bearing zones. Cable-tool drilling is the method of choice for this task because the quantity of drilling residuals is minimal compared with alternative methods (e.g., air rotary or mud rotary) and the discharge of formation water and cuttings from the hole can be easily controlled. However, other drilling techniques may be considered, as discussed in the following paragraph.

Cable-tool drilling must be used at all wells until the upper permeable aquifer zone is penetrated and cased off. Thus, cable tool will be used at all single (shallow) well locations. At cluster sites, the deepest hole will be drilled first; cable-tool drilling will be used for the total depth on this initial hole. If the results of field monitoring and chemical sampling indicate that the location is void of contamination, then alternative methods (e.g., mud rotary) may be considered on subsequent holes at that location. In any event, the "starter holes" (i.e., the first stage through the upper permeable zone) will be drilled with cable tool for all holes.

Where appropriate, questions about methods and approach can be left to field judgments.

At cable tool holes, drive casings will be telescoped to minimize cross contamination between hydrostratigraphic zones, and as required for casing pull-back. As a minimum, distinct hydrostratigraphic units and contaminated zones shall be cased off and sealed before preceding downward with further drilling. An example of telescoping casing for D-level completion is presented in Figure 5-5. The number and diameters of casings illustrated in Figure 5-5 is considered the minimum requirement when targeting a zone below the lower Ringold Formation. Wells completed in zones above the blue clay may have smaller diameter starter holes, keeping in mind that the minimum borehole size at the zone of completion will be 10 in.

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(25 cm) in diameter. In all cases, a minimum 2-in. (1-cm) thick sandpack will be installed per typical well completion requirements. Washington State Department of Ecology approval must be granted in instances where drive casing is not removed. Workover or pull-back rigs will be considered as a cost-effective alternative to cable rigs to pull back drive casing, place grout, and install the monitoring well. Three soil samples will be collected from the vadose zone at each cluster or single well location. The approximate depths and chemical analyses for the samples are presented under Task 5—Vadose Zone Investigation (Section 5.1.5). Geologic samples will be collected at changes in lithology and at a minimum of 10-ft (3-m) intervals from ground surface to total depth in the deep completion at cluster locations and at all single well completions. Continuous samples will be collected at 199-B10-1D. Sampling procedures are described under Task 3—Geologic Investigation (Section 5.1.3) and in Section 4 of the Field Sampling Plan (Attachment 1). Samples for vertical permeability analysis will be collected from the lower Ringold Formation (blue clay) and other stratigraphic horizons at the discretion of the project hydrogeologist. Samples of the blue clay will be collected at the 199-B10-1D, -2C, -3D, and -4D wells. At a minimum, two samples at distances of 10 and 50 ft (3 and 15 m) below the upper contact of the "blue clay" and coarser sediments will be collected at the D-level completions. A minimum of one sample, at a distance of 10 ft (3 m) below the top of the "blue clay," will be collected at the 199-B10-2C well.	**The work plan notes issues that require stakeholder involve-ment.** **Work plan tasks are specific about what must be accomplished, but they allow flexibility for dealing with uncertainties.**

Submodule 1.5 Work Plan Preparation

Scoping

- 1.1 Project Management Approach
- 1.2 Site Understanding
- 1.3 Initial Evaluation
- 1.4 Data Collection Plan
- **1.5 Work Plan Preparation**

1.5 Work Plan Preparation

- Work Plan Development
- RI/FS Task Development
- Appendices Development

Submodule 1.5 Work Plan Preparation

Background

The work plan explains the RI/FS project background and rationale, and presents detailed plans for the RI/FS project. The work plan, regardless of who implements it, should be developed to a level of detail and specificity such that another contractor could implement it without serious difficulty in understanding the scope or direction. The development of consensus throughout the scoping process eases drafting and finalizing of the work plan; a detailed and specific approach for conducting the risk assessment must be presented in the work plan. This approach will be a matter of considerable interest to the regulators. If they have been instrumental in developing the approach, approval of that portion of the work plan is simplified.

Organization

Submodule 1.5 discusses the following:

- Work Plan Development
- RI/FS Task Development
- Appendices Development

In addition, more detailed information is provided in the following notes:

- Note A–Example RI/FS Work Plan Format
- Note B–Field Sampling Plans
- Note C–Example FSP Task
- Note D–Health and Safety Plans

Sources

1. U.S. DOE, January 1991, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-08, Draft A.

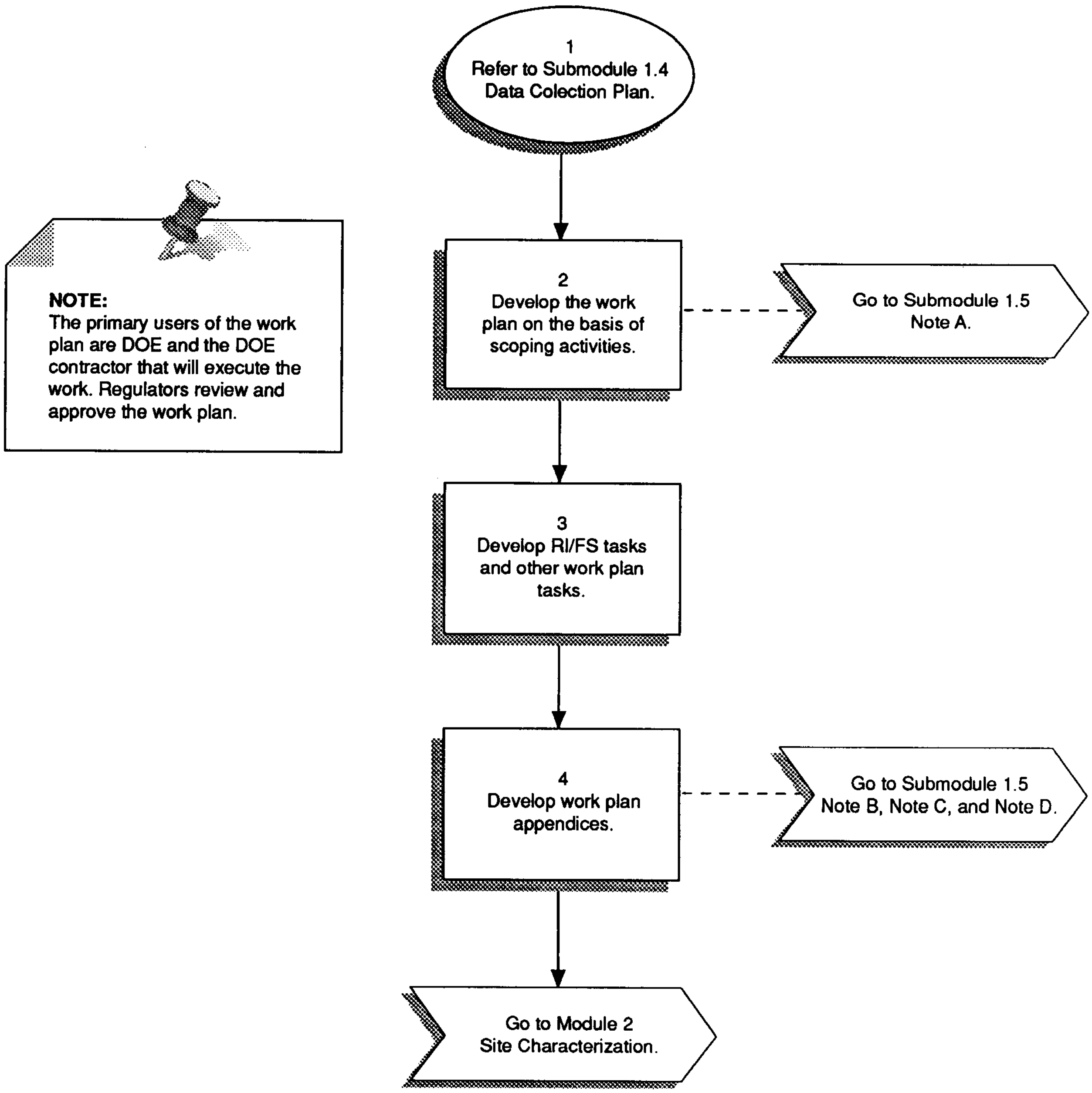
2. U.S. DOE, October 1991, *Guidance on Public Participation for U.S. Department of Energy Environmental Restoration Activities*, Final, Pacific Northwest Laboratory, Richland, Washington.

3. U.S. EPA, December 1987, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, OSWER Directive 9355.0-14.

4. U.S. EPA, June 1988, *Community Relations in Superfund: A Handbook*, Interim Version, EPA/540/G-88/002, OSWER Directive 9230.0-38.

5. U.S. EPA, October 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Interim Final, EPA/540/G89/004, OSWER Directive 9356.3-01.

Submodule 1.5 Work Plan Preparation



Step 1. Refer to Submodule 1.4, Data Collection Plan.

Step 2. **Develop the work plan on the basis of scoping activities.** Work plans typically are organized as follows: Chapter 1, Introduction; Chapter 2, OU Background and Physical Setting; Chapter 3, Initial Evaluation; Chapter 4, Work Plan Rationale; and Chapter 5, RI/FS Tasks (see Submodule 1.5, Note A).

The previous scoping activities relate directly to these chapters. For example, products of Submodule 1.2, Site Understanding, will be used to develop Chapter 2, OU Background and Physical Setting. Products of Submodule 1.3, Initial Evaluation, will be used to help develop Chapter 3, Initial Evaluation. Submodules 1.1, Initial Strategy and 1.4, Planning Data Collection will support development of Chapter 4, Work Plan Rationale. Working in part from the products of Submodule 1.4, Chapter 5 of the work plan, RI/FS Tasks, will be developed as a part of this submodule.

The focus of the extended project team and stakeholder meetings throughout the scoping process has been to encourage communication and to gain regulatory consensus on site understanding, PRGs, and scope of the RI/FS project. At this point, consensus within the extended project team should have been achieved on every significant issue that will form the work plan.

Step 3. **Develop RI/FS tasks and other work plan tasks.** In addition to the RI tasks developed in Submodule 1.4, Data Collection Plan, detailed task descriptions are necessary for the major activities in the FS. These tasks include data evaluation, risk assessment, and alternatives development and screening.

Each RI task can be organized around the medium to be investigated (e.g., surface water, soils, waste sources). Each element of a task (e.g., surface water) should be derived from and explicitly tied to an identified data need (see Submodule 1.3, Initial Evaluation and Submodule 1.4, Data Collection Plan). Just as each task element is derived from an identified data need, each task element should also have a discrete product (data type) as an output.

FS tasks are not developed in as much detail as the RI tasks. FS tasks tend to be more standardized, at least at the level of detail appropriate to a work plan. Their description in a work plan thus tends to be more generic.

Step 4. **Develop work plan appendices.** The FSP provides guidance on all fieldwork by detailed definition of sampling and data-gathering methods to be used on a project. Guidance for selection and definition of field methods, sample procedures, and custody is provided in the *Compendium of Superfund Field Operations Methods* (EPA, 1987). Some DOE facilities have developed specific field procedures. Specific DOE requirements for field methods, sampling procedures, and custody will apply for radioactive contaminants. Procedures in the FSP should include referenced sources whenever possible. The FSP is prepared before fieldwork begins, but may be amended or revised many times during fieldwork. See Submodule 1.5, Notes B and C, for additional detail.

QAPPs describe policy, organization, functional activities, and quality assurance/quality control (QA/QC) protocols required for the project. QAPPs are required by EPA QAMS-005. Some information in the QAPP can be incorporated by reference to

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other sections of the work plan; for example, DQOs required in the QAPP can be referenced to their use in Chapter 4 (rationale) of the work plan. Precision, accuracy, representativeness, completeness, and comparability (PARCC) are measures of the quality and usability of data discussed in the QAPP. For additional guidance on the QAPP, consult *Preparing Perfect Project Plans: Pocket Guide for Preparing Quality Assurance Project Plans* (EPA/600/9-89-087) 1989.

Submodule 1.5, Note D, lists 11 elements that should be included in site HSPs. The Occupational Safety and Health Administration (OSHA) requires safety briefings before initiation of any site activity. Some DOE facilities may have developed generic HSPs for incorporation into site-specific work plans. One reason for this incorporation is liability. Contractors are sensitive about preparing HSPs for another contractor's use. Unless the contractor that prepares the HSP will do all the work, the HSP needs to be a generic plan that can be used as a basis for each contractor's fieldwork and their own independent HSP based on the generic work plan.

The management plan covers the RI/FS management structure and operation. The management plan should be specific if the contractor that prepares the work plan also completes the RI/FS. The management plan should be general if a different contractor completes the RI/FS.

Facility-wide community relations plans exist for CERCLA and RCRA activities at each DOE facility. These generally determine the activities required for the project's community relations. To avoid duplication, CRPs that are included in work plans often reference the facility-wide CRP, but they also address any unique issues that are learned during the scoping process and that are raised by stakeholders. Detail on CRPs is provided in *Guidance on Public Participation for U.S. Department of Energy Environmental Restoration Activities* (DOE, 1991).

Plans for managing IDW are required to ensure that regulatory requirements are met. This plan should be included as an appendix to the work plan. Many DOE sites have already developed sitewide IDW plans. The OU plan should reference any existing sitewide plan and tailor it to any unique aspects of the OU. For example, the OU plan should identify each IDW generated and how it will be managed. This includes all matter traditionally thought of as IDW (e.g., purge water, drill cuttings) and samples sent for analysis, samples returned from laboratories, and any personal protective equipment or other equipment that could become contaminated.

If a sitewide IDW plan does not exist, the IDW plan for the OU will be more extensive, and must address general procedural requirements in addition to specific IDW management requirements. General principles of IDW management that should be included in a more detailed plan include initial handling of IDW from all activities, handling of IDW during sampling and analysis activities, and final management of IDW (e.g., immediate disposal or interim storage until final remedy is implemented).

IDW requirements for treatability studies will be addressed in Module 3.

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<u>Note A</u>. **<u>Example RI/FS Work Plan Format</u>**.

OPERABLE UNIT 100-BC-5

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	QAPP	Quality Assurance Project Plan	
	HSP	Health and Safety Plan	
	PMP	Project Management Plan	
	DMP	Data Management Plan	
	IDW	Investigation-Derived Waste Management Plan	
	CRP	Community Relations Plan	

*Treatability studies are discussed in Module 3.

Note A: Example RI/FS Work Plan Format (continued)

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Note B.

Field Sampling Plans. FSPs provide detailed field procedures and objectives to be followed by field sampling teams. Standard procedures (e.g., taking a split-spoon sample through a hollow-stem auger) can be incorporated by reference.

The FSP generally follows the task structure developed in Chapter 5, RI/FS Tasks.

Six main elements of the FSP are as follows:

1. Sampling Objectives
   - Specific objectives of sampling effort; clear and succinct
2. Sample Locations and Frequency
   - Rationale and techniques used to determine sample locations and frequency
   - Table shows every sample to be taken and analysis required
   - Maps and drawings show sample location
3. Sample Numbering System
   - Developed for each project
   - Code for numbering should contain information regarding sample location (well and boring number), sampling round, media, and site name
4. Sampling Equipment and Procedures
   - Usually incorporated by reference unless a special procedure developed for specific site
5. Sample Handling and Analysis
   - Table shows for each sample type−the packaging, presentation, and analytical requirements, including holding times
   - Examples of chain-of-custody paperwork
6. Handling and Disposal of Investigation-Derived Wastes
   - Often a difficult issue that should have been resolved with the regulatory agencies starting at the stakeholder meeting
   - Specific plans for handling such waste that the regulatory agencies can review and approve as the requirement

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<u>Note C</u>. **<u>Example FSP Task</u>.** The work plan should briefly describe each RI and FS task separately in the FSP. The detailed descriptions in the Rationale and Approach section of the work plan serve as background for the task descriptions in the FSP, which are briefer and do not repeat the rationale and objectives.

This example task description is an excerpt from a draft work plan for the Hanford Site. The 100-BC Area at Hanford includes the B Reactor area and the C Reactor area. The surface sources and facilities have been divided into four OUs (100-BC-1, 100-BC-2, 100-BC-3, and 100-BC-4). The groundwater beneath the entire 100-BC Area is OU 100-BC-5. This excerpt is from a draft of the 100-BC-5 RI/FS work plan. Its use is illustrative and does not necessarily represent activities currently under way in the 100-BC Area at Hanford.

FSP task descriptions should provide only essential details of what is to be done and focus instead on methods and other essential information. Uncertainties in how the task should be carried out should be clearly delineated and left to the field team to resolve in the field. For example, this task description notes uncertainties about the best locations for some of the wells, provides the guidance that is possible, and leaves the final decision to the field team.

This is an unedited version of an FSP task description as it appeared in the draft work plan (U.S. DOE, January 1991, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-5 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-08, Draft A).

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7.2.3 Activity 6b-3--Drilling and Sampling

7.2.3.1 Well Designations. New monitoring wells constructed in the 100-B/C Area will be given designations consistent with the existing wells onsite. These wells have been designated through 199-B-9. A typical designation for the first new well would be 199-B10-1A. The first portion of the designation, "199," refers to a monitoring well in the 100 Area. The second portion, "B10," refers to the tenth episode of monitoring well construction in the 100-BC Area. The third portion of the designation, "1A," refers to the specific well within the tenth construction episode. For well clusters, additional wells at the same location will be designated 1B, 1C, 1D, etc. In this portion of the designator, the letter will indicate a specific hydrostratigraphic interval to be monitored, as discussed in Section 5.1.6 of the Work Plan.

The "A-level" wells will be screened at the top of the saturated zone at a depth of 50 to 100 ft (15 to 30 m). The depth and screen placement of the "B-, C-, and D-level" will be determined in the field upon completion of the deep wells at the cluster locations. In concept, "B-level" wells will be screened at the base of the upper sand and gravel aquifer unit in the middle Ringold Formation. This zone, if present, will be marked by a change in material size and sorting that indicates a decrease in hydraulic conductivity from the coarser shallow aquifer. This zone may or may not represent a formational contact. The "C-level" completions are planned for the zone directly above the blue clay horizon in the lower Ringold Formation. "D-level" wells will be screened in the basal Ringold Formation directly below the blue clay.

The FSP allows flexibility to deal with site uncertainties, but is clear about investigation objectives.

7.2.3.2 Monitoring Well Locations. Twenty-four new monitoring wells (Table FSP-1) will be installed at the locations shown in Figure FSP-2. The locations are approximate and will be finalized after evaluation of information gathered in the source investigation and geophysical/radiation surveys. Eight locations are sited for single completions. Sixteen wells will be completed at five cluster locations. A well cluster consists of two or more well completions at a single location.

7.2.3.3 Drilling. Drilling methods will follow protocol presented in EII 1.6. The drilling program is designed to meet the goals and objectives of Task 6, minimize exposure to field personnel, and mitigate the possibility of cross contamination between water-bearing zones. Cable tool drilling is the method of choice for this task because the quantity of drilling residuals is minimal compared with alternative methods (e.g., air rotary, mud rotary), and the discharge of formation water and cuttings from the hole can be easily controlled. However, other drilling techniques may be considered.

Methods.

Cable tool drilling must be used at all wells until the upper permeable shallow zone is penetrated and cased off. Thus, cable-tool drilling will be used at all single (shallow) well locations. At cluster sites, the deepest hole will be drilled first; cable-tool drilling will be used for the total depth on this initial hole. If the results of field monitoring and chemical sampling (vadose zone samples) indicate that the location is not contaminated,

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then alternative methods (e.g., mud rotary) may be considered on subsequent holes at that location. In any event, the "starter holes" (i.e., the first stage through the upper permeable zone) will be drilled with cable tool.

At cable-tool drilled holes, drive casings will be telescoped to minimize cross contamination between hydrostratigraphic zones, and as required for casing pull-back. As a minimum, distinct hydrostratigraphic units and contaminated zones shall be cased off and sealed before preceding downward with further drilling. An example of telescoping casing for D-level completion is presented in Figure FSP-4. The number and diameters of casings illustrated in Figure FSP-4 are considered the minimum requirement when targeting a zone below the Lower Ringold Formation. Wells completed above the blue clay unit may have smaller starter holes, keeping in mind that the minimum borehole size at the zone of completion will be 10 in. (25 cm).

Wherever possible, drive casing should be left in place. Ecology approval must be granted before this option is exercised. If multiple casing strings must be pulled back, then a workover or pull-back rig, with greater lifting capacity, may be used to pull back casing, place grout, and install the well.

7.2.3.4 Sampling. Three soil samples will be collected from the vadose zone at each cluster or single well location. The approximate depths and chemical analyses for the samples are presented in Section 6--Vadose Zone Investigation.

Samples to be collected.

Geologic samples will be collected at changes in lithology and at a minimum of 10-ft (3-m) intervals from ground surface to total depth in the deep completion at cluster locations and at all single well completions. Continuous samples will be collected at 199-B10-1D. Sampling procedures are described under Section 4--Geologic Investigation.

Samples for vertical permeability analysis will be collected from the lower Ringold Formation (blue clay) and other stratigraphic horizons at the discretion of the project hydrogeologist. Samples of the blue clay will be collected at the 199-B10-1D, -2C, -3D, and -4D wells. At a minimum, two samples at distances of 10 and 50 ft (3 and 15 m) below the upper contact of the "blue clay" and coarser sediments will be collected at the D-level completions. A minimum of one sample, at a distance of 10 ft (3 m) below the top of the "blue clay," will be collected at the 199-B10-2C well.

Minimum sampling requirements are not within the discretion of the field team to change.

7.2.3.5 Decontamination. Decontamination procedures have been established for the Hanford Site by Westinghouse Hanford and are provided in WHC-CM-7-7 (WHC 1988). Included in these sections are general decontamination requirements and specific methods for radiological and nonradiological contamination. EII 5.4 establishes methods for decontaminating drilling equipment to mitigate cross-contamination during drilling or sampling activities.

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<u>Note D</u>.   <u>Health and Safety Plans</u>.

Elements of a Health and Safety Plan

1. The name of a site health and safety officer and the names of key personnel and alternatives responsible for site safety and health

2. A health and safety risk analysis for existing site conditions and for each site task and operation

3. Employee training assignments

4. A description of Personal Protective Equipment to be used by employees for each of the site tasks and operations

5. Medical surveillance requirements

6. A description of the frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation

7. Site control measures

8. Decontamination procedures

9. Standard operating procedures for the site

10. A contingency plan that meets the requirements of 29 CFR 1910.120(1)(1) and (1)(2)

11. Entry procedures for confined spaces

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